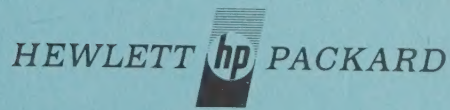


526D PHASE UNIT

OPERATING AND SERVICE MANUAL



CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

All Hewlett-Packard products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

For any assistance contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.



OPERATING AND SERVICE MANUAL

MODEL 526D PHASE UNIT

SERIALS PREFIXED: 616-

This manual applies directly to standard  Model 526D Phase Unit having serial prefix number 616.

OLDER INSTRUMENTS

This manual with changes provided in Appendix I also applies to models having serial prefix number 209, 134, and 117.

SPECIAL INSTRUMENTS AND SERIAL PREFIXES NOT LISTED

The information required to relate this manual to special modifications, or to newer instruments with serial prefixes not listed is supplied on special insert sheets. If this information is missing, contact any  sales and service office, giving full specification number, instrument name, and serial number.

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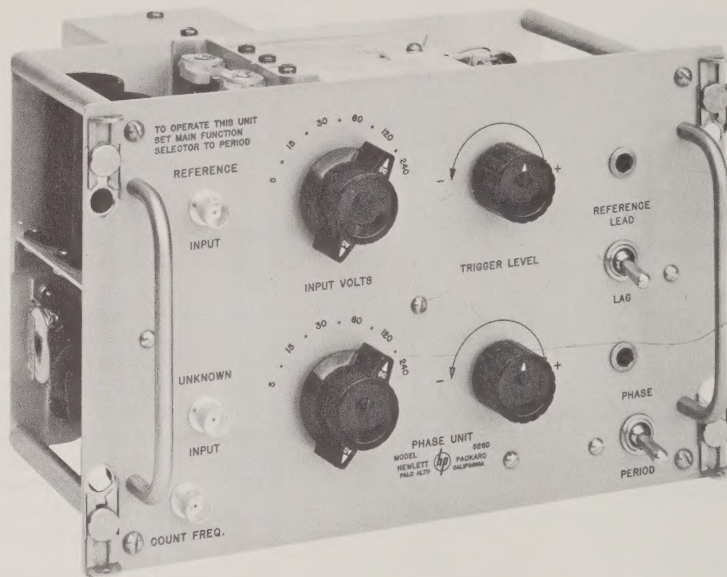


Figure 1-1. Model 526D Phase Unit

Table 1-1. Specifications

RANGE:	Phase angle, 0 to 360°, lead or lag
FREQUENCY RANGE:	1 cps to 20 kc
READS IN:	Time units with maximum resolution of 0.1 μ s for full frequency range. For frequencies 396 to 404 cps, a frequency multiplier (3600X) provides readings direct in tenths of degrees.
ACCURACY:	$\pm [0.5^\circ + (F_p/F_c + F_p \times 10^{-6}) \times 360^\circ]$ where F_p is frequency of phase-measured signal, and F_c is counted frequency . . . assuming noise 65 db below signal and negligible counted frequency error. S/N ratio influences accuracy (see "Introduced Noise"). Accuracy diminishes, somewhat, below 350 cps when ac-coupled. For highest accuracy both inputs should be coupled in the same mode, ac or dc.
INPUT VOLTAGE:	5 to 120 volts rms. Usable to 240 v rms.
INPUT IMPEDANCE:	Approximately 1 megohm, 70 pf shunt.
DIMENSIONS:	Plug-in unit for the Model 524B, 524C, or 524D Electronic Counters
WEIGHT:	Net 5 lbs. Shipping 9 lbs.

SECTION I

GENERAL INFORMATION

1-1. DESCRIPTION AND PURPOSE.

1-2. The Φ Model 526D Phase Unit enables any Φ Model 524B, C, or D Electronic Counter to make accurate measurements of the phase angle between two signals in the 1 cps to 20 kc range. The counter indication is presented in time units with a resolution of ± 0.1 microseconds. When the Model 526D is used in the frequency range of 396 to 404 cps, an indication can be read directly in tenths of degrees. Figure 1-1 is an overall view of the instrument.

1-3. USES.

1-4. The Model 526D can be used to measure the phase angle of transformers, resolvers, amplifiers,

phase-shift networks, phase angle between two and three phase power lines, etc. The phase angle of most devices operating in the range of 1 cps to 20 kc can be easily measured.

1-5. INSTRUMENT IDENTIFICATION.

1-6. Hewlett-Packard uses a two-section eight-digit serial number (000-00000). If the first three digits of the serial number on your instrument do not agree with those on the title page of this manual, change sheets supplied with the manual will define differences between your instrument and the Model 526D described in this manual.

SECTION II

INSTALLATION

2-1. MECHANICAL INSPECTION.

2-2. Unpack the instrument upon receipt and inspect it for signs of physical damage such as scratched panel surfaces, broken knobs, etc. If there is any apparent damage, notify carrier and nearest Hewlett-Packard Field Office (listed at back of manual) immediately.

2-3. INSTALLATION INSTRUCTIONS.

2-4. Insert the Model 526D into the counter plug-in chamber as far as possible. Make sure the four slide catches are not covering the holes under the catches. Push in on the phase unit, slide the catches around the posts appearing in the holes.

2-5. Set the Model 526D PHASE PERIOD switch to PHASE and the counter FUNCTION SELECTOR to PERIOD.

2-6. IN-CABINET PERFORMANCE CHECK.

2-7. If an in-cabinet performance check is desired, refer to section V of this manual.

2-8. POWER REQUIREMENTS.

2-9. Power for the Model 526D is supplied by the electronic counter.

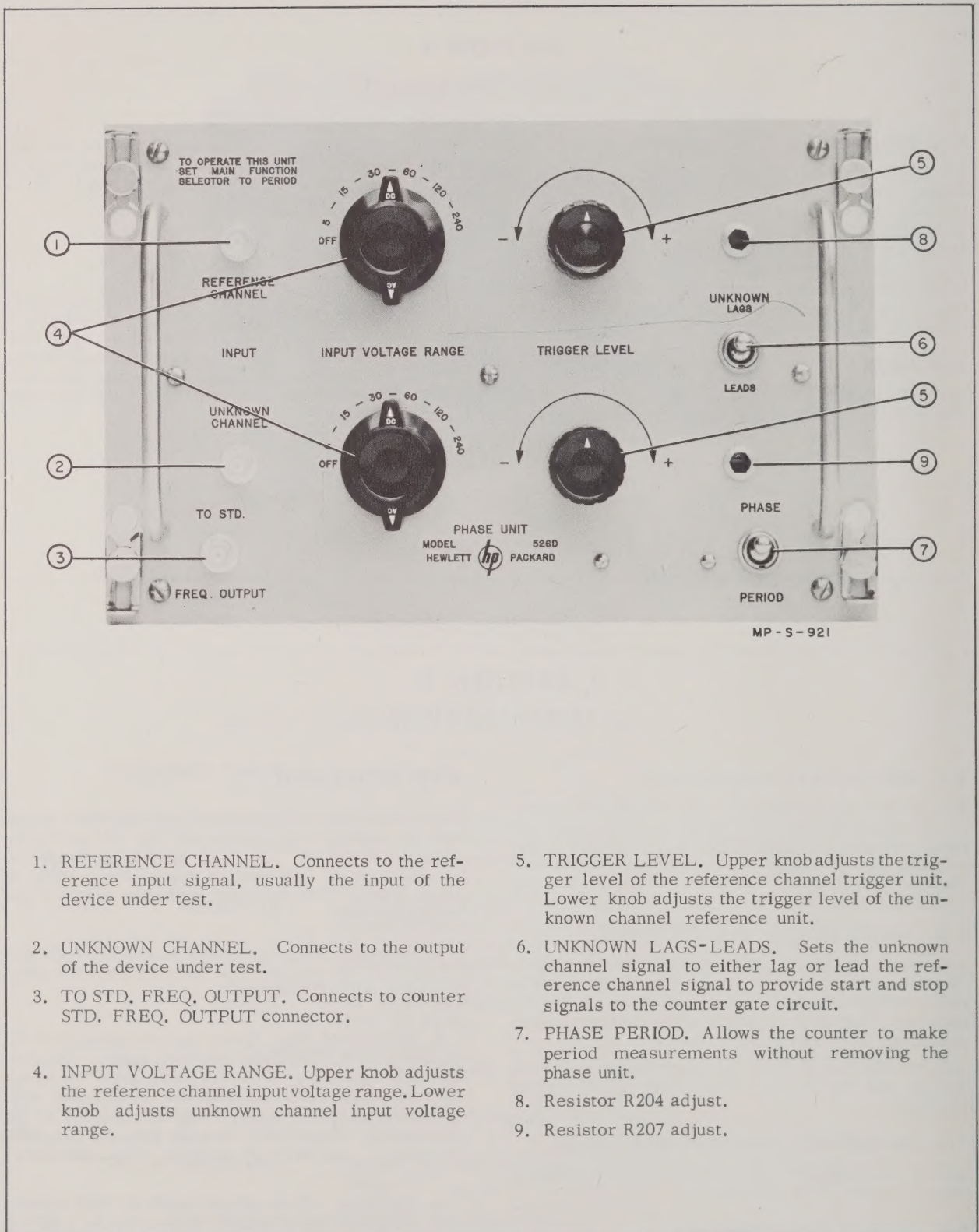
2-10. RESHIPMENT.

2-11. To protect valuable electronic equipment during storage or shipment, always use the best packaging methods available. Contract packaging companies in many cities can provide dependable packing on short notice. The following packaging methods are recommended:

a. Original. Place instrument in original container. Replace all packing pads and fillers in the exact position they originally occupied.

b. Rubberized Hair. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument securely in strong corrugated container (350 lb/square inch bursting test) with 2-inch rubberized hair pads placed along all surfaces of the instrument. Insert filler between pads and container to insure a snug fit on all surfaces of the instrument.

c. Excelsior. Cover painted surfaces with protective wrapping paper. Pack instrument in a strong corrugated container (350 lb/square inch bursting test) with a layer of excelsior about 6 inches thick, packed firmly against all surfaces of the instrument.



1. REFERENCE CHANNEL. Connects to the reference input signal, usually the input of the device under test.
2. UNKNOWN CHANNEL. Connects to the output of the device under test.
3. TO STD. FREQ. OUTPUT. Connects to counter STD. FREQ. OUTPUT connector.
4. INPUT VOLTAGE RANGE. Upper knob adjusts the reference channel input voltage range. Lower knob adjusts unknown channel input voltage range.
5. TRIGGER LEVEL. Upper knob adjusts the trigger level of the reference channel trigger unit. Lower knob adjusts the trigger level of the unknown channel reference unit.
6. UNKNOWN LAGS-LEADS. Sets the unknown channel signal to either lag or lead the reference channel signal to provide start and stop signals to the counter gate circuit.
7. PHASE PERIOD. Allows the counter to make period measurements without removing the phase unit.
8. Resistor R204 adjust.
9. Resistor R207 adjust.

Figure 3-1. Front Panel Controls and Connectors

SECTION III OPERATION

3-1. GENERAL DESCRIPTION.

3-2. The Model 526D, when used with a Model 524 Electronic Counter, measures the phase angle between two signals of the same frequency. Input attenuators and trigger level controls on the Model 526D permit accurate setting of trigger points on the negative-going zero-axis crossings of the signals.

3-3. INPUT ATTENUATORS.

3-4. Input attenuators permit phase angle measurements of signals from 5 to 120 volts rms in the frequency of 1 cps to 20kc. The 120-240 position is used only to adjust TRIGGER LEVEL for 60-120 volt range.

3-5. REFERENCE and UNKNOWN CHANNEL attenuators have an AC and DC position. When the letters DC on the attenuator knob are adjacent to the voltage range, input is direct coupled. When the letters AC on the attenuator knob are adjacent to the voltage range, the input is ac coupled. The OFF position disconnects the attenuators from the input connectors and the trigger units.

3-6. AC coupling must be used if the signals to be phase measured have a dc component. When ac coupled the maximum dc that may be applied is 600 volts.

Note

When using the Model 526D in the low audio range of frequencies (1 cps to 100 cps), if ac coupling is used for one channel, use ac coupling for both channels. Direct(dc) coupling is desired.

3-7. TRIGGER LEVEL.

3-8. The TRIGGER LEVEL controls adjust the trigger units to provide command signals for the counter on the negative-going zero-axis crossing of the REFERENCE and UNKNOWN CHANNEL signals.

3-9. FRONT PANEL CONTROLS & CONNECTORS.

3-10. Figure 3-1 shows the front panel controls and connectors and lists the function of each.

3-11. 400 CYCLE OPERATION. (Reads Degrees)

3-12. To measure the phase angle of 400 cycle devices, proceed as follows:

a. Set the counter TIME UNIT switch to EXT. and the FUNCTION SELECTOR switch to PERIOD.

b. Connect a coaxial cable from the Model 526D TO STD. FREQ. OUTPUT connector to counter STD. FREQ. OUTPUT connector.

c. Measure the REFERENCE CHANNEL input voltage with an rms indicating vacuum tube voltmeter, then set the REFERENCE CHANNEL INPUT VOLTAGE RANGE attenuator to the range of the voltage.

d. Repeat step c for the UNKNOWN CHANNEL.

e. Set the UNKNOWN LAGS-LEADS switch to LAGS.

f. Set the PHASE PERIOD switch to PHASE.

g. Connect the input of the device under test to the REFERENCE CHANNEL and the output of the device to the UNKNOWN CHANNEL. Supply a 400 cps $\pm 1\%$, 5 to 120 volt rms signal to the input of the device under test (see figure 3-2).

h. Set the REFERENCE CHANNEL TRIGGER LEVEL to mid-position. Note the counter indication.

i. Set the REFERENCE CHANNEL VOLTAGE RANGE attenuator to the next higher range. If the counter indication changes, the trigger lever adjustment is incorrect.

j. If the counter indications are different, note direction and amount of difference. If the second counter indication is larger than the first (step h) adjust the REFERENCE CHANNEL TRIGGER LEVEL until the counter displays the first indication minus the difference. If the second counter indication is smaller than the first, adjust the REFERENCE CHANNEL TRIGGER LEVEL until the counter displays the first indication (step h) plus the difference. For example, if the counter indication is 130.0° on the proper input voltage range and the counter indication on the next higher range was 140.0°, then adjust the REFERENCE CHANNEL TRIGGER LEVEL until the counter indicates 120.0°. If the counter indicator is 150.0° on the proper input voltage range, and the counter indication on the next higher voltage range is 130.0°, then adjust the REFERENCE TRIGGER LEVEL until the counter indicates 170.0°. Refer to paragraph 4-3 for an explanation of this adjustment.

k. Repeat steps i and j until the counter indication does not change more than $\pm 0.1^\circ$.

m. Repeat steps i, j, and k, using the UNKNOWN CHANNEL control.

n. After setting trigger level for both channels, the counter indication is the phase angle between signals, in tenths of degrees. Setting UNKNOWN LAGS-LEADS switch to LEADS will give a counter indication of 360.0° minus the first phase angle. For instance, if the phase angle were 90.5°, setting the switch to UNKNOWN LEADS will give a counter indication of 269.5°. If the two indications, when added together do not equal 360.0° $\pm 0.2^\circ$, repeat steps c through m.

3-13. 1 CPS TO 20 KC OPERATION.

(Reads PERIOD)

3-14. When phase angle measurements are to be made in the frequency range 1 cps to 20 kc, proceed as follows:

Note

Disconnect the coaxial cable from phase unit TO STD. FREQ. OUTPUT connector and counter STD. FREQ. OUTPUT connector, when using 1 cps to 20 kc operation.

a. Set the Model 526D PHASE PERIOD switch to PERIOD. This will enable the counter to measure the period of the input frequency.

b. Connect the input of the device under test to the SIGNAL INPUT connector of the counter (see figure 3-2). Set the counter FUNCTION SELECTOR to PERIOD and the TIME UNIT switch to MICROSEC. The counter will measure the period in microseconds. Note and record the indication. Suppose the frequency is 1390 cps. The counter indicates a period of 719.4 microseconds.

c. Measure the REFERENCE CHANNEL input voltage with an rms-indicating vacuum tube voltmeter, then set the REFERENCE CHANNEL INPUT VOLTAGE RANGE attenuator to the range of the voltage. Repeat the above for the UNKNOWN CHANNEL.

d. Connect the input of the device under test to the REFERENCE CHANNEL INPUT connector, and the

output of the device to the UNKNOWN CHANNEL INPUT connector.

e. Set the Model 526D UNKNOWN LAGS-LEADS to LAGS and PHASE PERIOD switch to PHASE.

f. Set the REFERENCE CHANNEL TRIGGER LEVEL to mid-position. Note the counter indication.

g. Set REFERENCE CHANNEL VOLTAGE RANGE attenuator to the next higher range. If the counter indication is different, note the direction and amount of change. Over-correct this change by a factor of one. For instance, if the original counter indication was 670.0, and the counter indication at the next higher range was 690.0, then adjust the REFERENCE CHANNEL TRIGGER LEVEL until counter indicates 650.0. (Since the first counter indication was 670.0 and the second indication was 690.0, the difference is 20; over-correcting by one, 20 subtracted from 670.0 is 650.0.) Set REFERENCE CHANNEL INPUT VOLTAGE RANGE attenuator to proper position (step c). The counter indication should remain unchanged. If counter indication changes, repeat the procedure above until counter indication does not change when changing input voltage ranges. Refer to paragraph 4-3 for an explanation of this adjustment.

h. Repeat steps f and g using the UNKNOWN CHANNEL controls.

i. After step h has been completed, the counter indication is the number of microseconds that occurred

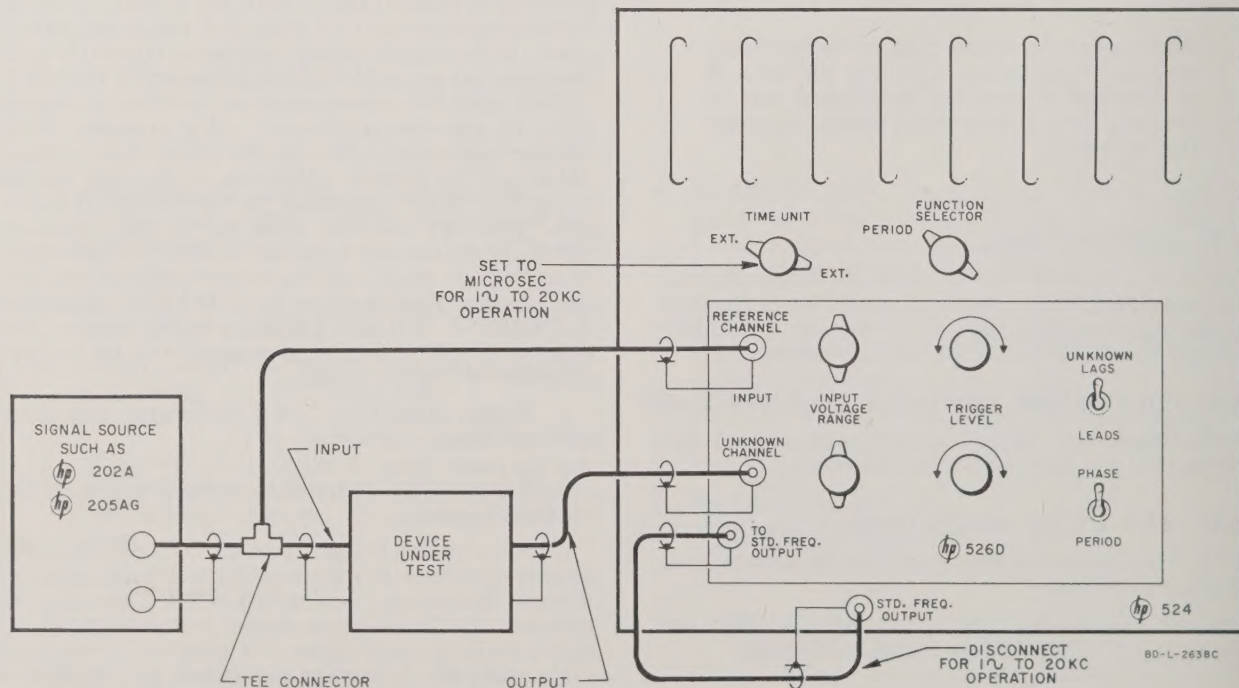


Figure 3-2. Equipment Connections for Measuring Phase Angle of a Device

between the zero-axis crossings of the reference and unknown signals. The phase angle can be calculated from the following formula:

$$\text{phase in degrees} = \frac{t_{\phi}}{T} \times 360.0^{\circ}$$

where t_{ϕ} = counter indication of the phase-angle in microseconds (i. e. the time between the negative-going zero-axis crossing of the reference channel input and unknown channel input).

T = the period in microseconds of the input signal (refer to step b above).

For example, if counter indication is 650.0 microseconds and the period of the input signal is 719.4 microseconds, then the phase-angle is:

$$\frac{650.0}{719.4} \times 360.0^{\circ} = 325.3^{\circ}$$

3-15. CONVERSION FORMULA.

(Alternate Method)

3-16. When determining the frequency of a signal with the counter, period measurement is more accurate at frequencies below approximately 300 cps and frequency measurement is more accurate at frequencies above 300 cps. For additional information, refer to the counter Operating and Service Manual. When it is necessary to use a frequency measurement, the following formula can be used to calculate the phase angle:

$$\text{phase in degrees} = f_{\text{in}} \times t_{\phi} \times 360.0^{\circ} \times 10^{-6}$$

where f_{in} = frequency of the input signal in cps

t_{ϕ} = counter indication of the phase-angle in microseconds (i. e. the time between the negative-going zero-axis crossing of the reference channel input and unknown channel input).

Using the values from steps b and i of paragraph 3-13:

$$\begin{aligned} \text{phase} &= 1390 \times 650.0 \times 360.0^{\circ} \times 10^{-6} \\ &= 325.3^{\circ} \end{aligned}$$

3-17. ACCURACY.

3-18. Measurement accuracy of Model 526D is $\pm 0.5^{\circ} + (F_p/F_c + F_p \times 10^{-6}) \times 360^{\circ}$, where F is the frequency of the phase-measured signal, and F_c is the counted frequency. A signal to noise ratio of 65 db is assumed. When S/N ratio is less than that assumed, accuracy will be subject to those conditions described below under "introduced noise."

3-19. Harmonic distortion can affect the signal of the zero-axis crossing and, therefore, accuracy will be subjected to the phase relationship of the fundamental, (E_1) second harmonic (E_2) third harmonic (E_3), and... (E_m). To determine this error would require both amplitude and phase angle relationship of each harmonic be known. Maximum error that can exist can be

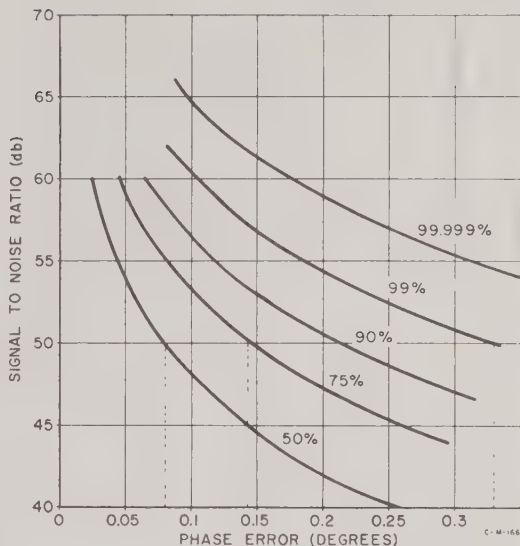


Figure 3-3. Probability of Error vs S/N Ratio

determined by knowing just the amplitude of E_1 , E_2 , E_3 ,... E_m or each harmonic which can be measured by using a wave analyzer. This error in degrees for each trigger is:

$$\text{Error}^{\circ} = \text{Arc sin} \left(\frac{E_2}{E_1} + \frac{E_3}{E_1} + \dots + \frac{E_m}{E_1} \right)$$

Since the phase relationship of the harmonics can be in or out of phase with the fundamental this error can vary from zero to the maximum value. As an example, if the second harmonic is .1% and the third harmonic is 1% of the fundamental amplitude, then maximum error would be:

$$\text{Arc sin} \left(\frac{.001}{1} + \frac{.01}{1} \right) = .63^{\circ}$$

Since the Model 526D can measure only the relative phase of the two signals at the input terminals, source impedance as well as cable capacitance can cause a phase shift to develop before the input terminals. At 400 cps if the source impedance is low (1000 ohm or less), and short cables are used then this shift will be negligible. At higher frequencies and higher source impedance calculations to determine this shift should be performed.

3-20. In the case of the 400 cps measurement, using the 3600 times-frequency multiplier, accuracy would be:

$$\pm [0.5 + (400/1.44 \times 10^6 + 400 \times 10^{-6}) \times 360^{\circ}] =$$

$\pm [0.5 + 0.244] = \pm 0.744^{\circ}$. As another example, a 1000-cps phase-angle measurement, counting 10 Mc, would have a maximum error of

$$\begin{aligned} &\pm [0.5 + (1000/10^7 + 1000 \times 10^{-6}) \times 360^{\circ}] = \\ &\pm [0.5^{\circ} + 0.396] = \pm 0.896^{\circ} \end{aligned}$$

3-21. INTRODUCED NOISE: Typical measurements in the presence of a given Gaussian noise level have an accuracy-probability distribution. The curves in Figure 3-3 show this probability distribution for Gaussian noise, and indicate the probability that error is

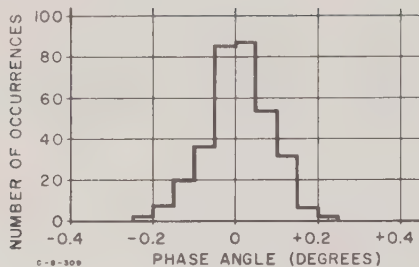


Figure 3-4. Measurement Distribution 60 cps Signal

less than that traced by the respective curves. For example, with a 53-db signal to Gaussian noise condition there is a 90% probability that any single measurement has less than 0.15° phase error because of the noise. But with a S/N ratio of 65 db, the probability of less error than 0.1° is 99.999%.

3-22. Figures 3-4 and 3-5 illustrate actual measurement results using the 526D for a large number of measurements, Figure 3-4 being power line frequency

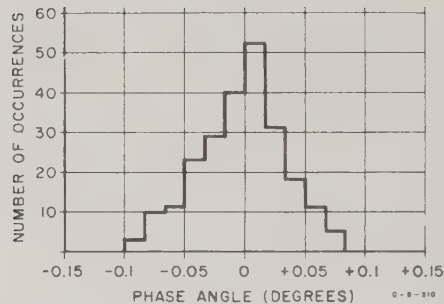


Figure 3-5. Measurement Distribution 200 cps Signal

(60 cps) with -32 db total distortion and Figure 3-5 being the 206A output (200 cps) with a -60 db total distortion. Reduced variation in measurement will result when there is lower noise, and the accuracy will increase, especially when S/N ratio is below 65 db, after several measurements are averaged; averaging has the same effect as lower noise, reducing the size of error. The scatter is due to noise only and phase accuracy is subjected to conditions in paragraph 3-18.

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. The phase difference of the two signals of the same frequency can be measured between any convenient reference. The Model 526D Phase Unit uses the negative-going zero-axis crossing as the reference point. The phase angle is usually expressed in degrees and thus is independent of frequency.

4-3. TRIGGER LEVEL.

4-4. Trigger level is set by comparing the counter indication at the proper input voltage range and the next higher range. The slope of the input signal is changed by a factor of two by setting the attenuator to the next higher range. This changes the intersection of the trigger level bias and the effective input signal. Refer to figure 4-1. When a signal is applied to the reference channel, it will cause the trigger unit to initiate a start command to the counter (point A in figure 4-2) if UNKNOWN LEADS-LAGS switch is in the LAGS position. The counter will count until it is supplied a stop command initiated by the unknown channel. Suppose the counter indication is 1300. When the attenuator is set to the next higher range, the slope of the input signal is reduced by a factor of two. The trigger unit now initiates a start command at point B. When the counter stops counting, suppose the indication is 1320. The difference between the indications is 20 (20 subtracted from 1300 is 1280). Adjusting the trigger level to give a counter indication of 1280 will cause the intersection of the trigger level bias and the effective input to occur at approximately point C. When the attenuator is set to its original range, the indication should remain unchanged, because the trigger signal is independent of slope when the trigger level bias is coincident with the zero crossing.

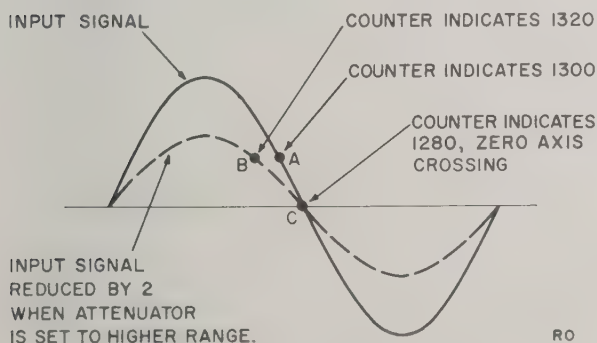


Figure 4-1. Trigger Level Setting

4-5. 400 CYCLE OPERATION.

4-6. When measurements in the range of 396 to 404 cps are made, the counter indication is read directly

in tenths of degrees. This is because of the X3600 multiplier. Refer to the functional diagram in fig. 4-2. Part of the reference input signal is applied to four full-wave rectifier type doubler circuits, two tripler circuits, and two X5 multiplier circuits. The output signal is always the 36 hundredth multiple of the reference input signal. Thus the time of one cycle of the reference input signal equals the time of 3600 cycles of the multiplied signal. The signal applied to the counter STD. FREQ. OUTPUT connector will be the 36 hundredth multiple of the unit frequency, lying between 1.42 and 1.46 mc. This signal is used as the counted frequency, each cycle representing a tenth of a degree.

4-7. When the REFERENCE CHANNEL trigger supplies a start command to the counter, it counts the multiplier output until the UNKNOWN CHANNEL trigger unit supplies a stop command to the counter. The maximum possible indication on the counter is 3600 (360.0°), which corresponds to one complete cycle of the REFERENCE CHANNEL input signal.

4-8. 1 CPS TO 20 KC OPERATION.

4-9. When phase-angle measurements are made in the frequency range of 1 cycle to 20 kc, the counter indicates intervals of time. The counter TIME UNIT switch is set to 10 MC, thus the counter indication is the time interval in microseconds with an automatic decimal point. When a start command is supplied from the Model 526D REFERENCE CHANNEL trigger unit, the counter indicates time in microseconds until a stop command is supplied from the UNKNOWN CHANNEL trigger unit. Then counter action stops. The indication on the counter is the time interval in microseconds, between the negative-going zero-axis crossings of the reference and unknown signals. The following formula will give the phase angle in degrees:

$$\text{phase in degrees} = f_{in} \times t_{\phi} \times 360.0^{\circ} \times 10^{-6}$$

where f_{in} = the frequency of the input signal in cps,

t_{ϕ} = counter indication of the phase-angle in microseconds (i. e. the time between the negative-going zero-axis crossings of the reference channel input and unknown channel input).

Since $f_{in} = \frac{10^6}{T}$, where T is the period in microseconds of f_{in} , phase in degrees also equals $\frac{t_{\phi}}{T} \times 360.0^{\circ}$.

4-10. POWER SUPPLY.

4-11. The dc voltage for the filaments of V602 is supplied by the regulator in the Model 526D. Diodes CR205 and CR206 rectify and double the 6.3 volts ac. Diode CR204 supplies a reference voltage to the base of transistor Q202. If the 6.3-volt ac input to CR205 and CR206 increases, the collector of Q202 will become more negative. The current through Q202 will increase since the base is held at a fixed voltage by breakdown diode CR204. The increased current through Q202 causes an increase in the voltage across the base-to-emitter junction of Q201, tending to turn

Q201 off. With reduced current through Q201, the voltage across Q201 increases which compensates for the increase in input voltage and maintains a regulated output from the power supply. The voltage drop across R221 is larger, thus the voltage applied to the base of Q201 is less negative. This causes Q201 to conduct less, lowering the dc voltage applied to the filaments.

4-12. Diode CR203 is a 12-volt breakdown diode. It supplies voltage to the frequency multipliers. Voltage regulator V201 supplies a regulated 110-115 volts to the trigger units.

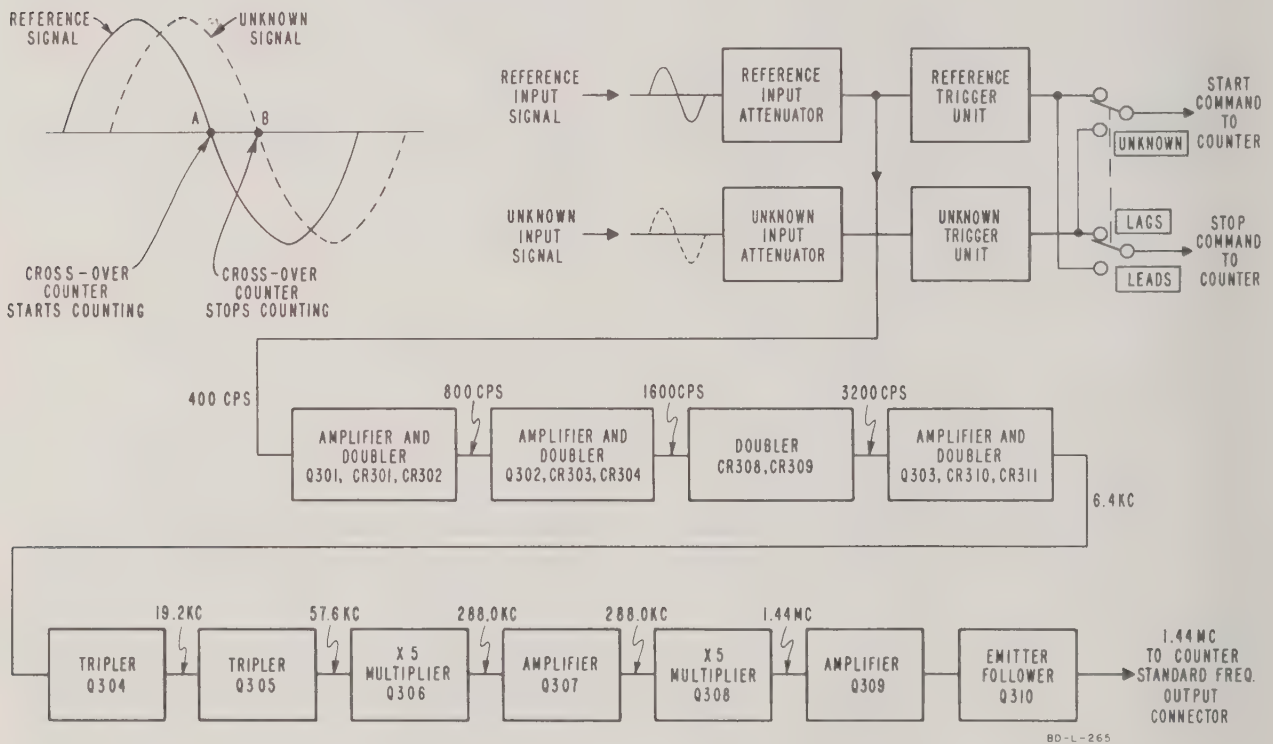


Figure 4-2. Functional Block Diagram

SECTION V

MAINTENANCE

5-1. INTRODUCTION.

5-2. Section V contains information relating to an in-cabinet performance check, troubleshooting, repair, and adjustment.

5-3. TEST EQUIPMENT REQUIRED.

5-4. The equipment or its equivalent listed in table 5-1 is required for an in-cabinet performance check, troubleshooting, and adjustment of the Model 526D.

5-5. TROUBLESHOOTING.

5-6. SECTIONALIZATION (1 cps to 20 kc operation). If the Model 526D should operate unsatisfactorily,

the section that is defective can be located by changing the front-panel controls and watching the counter indications. The following checks will enable the operator to sectionalize a trouble:

a. Apply a 1 kc signal to the REFERENCE CHANNEL INPUT connector. Set Model 526D UNKNOWN LAGS LEADS switch to LAGS. Set the PHASE PERIOD switch to PHASE. The counter should count. If the counter does not count, the reference channel trigger unit or attenuator may be defective.

b. Apply a signal to the UNKNOWN CHANNEL INPUT connector. Set the LAGS LEADS switch to LEADS. The counter should count. If the counter does not count, the unknown channel trigger unit or attenuator may be defective.

Table 5-1. Recommended Test Equipment.

Instrument Type	Required Characteristics	Use	Instrument Recommended
Oscilloscope	1 cps to 5 mc	Waveform observation	Ⓢ Model 150A with 152B
Voltage Divider Probe	10:1 Divider shunted by 10 pf	Circuit connections	Ⓢ AC-21A
AC Vacuum Tube Voltmeter	0 to 100 volts ac	Voltage measurements	Ⓢ Model 400D
DC Vacuum Tube Voltmeter	0 to 300 volts dc	Voltage and resistance measurements	Ⓢ Model 412A
Sine Wave Generator	1 cps to 20 Kc .06% distortion and 65 db signal to noise ratio	Signal Injection	Ⓢ 203A
Amplifier	.01% distortion, 5 w at 15 VRMS output	Signal Injection	Ⓢ 467A
Ratio Transformer	Low phase shift at 100 VRMS output	Signal Injection	ESI Dekatrans DT 1145
L-C Meter	Resolution of 0.5 pf at 70 pf Calibrated within 1% accuracy	Adjustment	Tektronix Model LC-130
Step-Up Transformer	100 VRMS at 5 w output; 12 VRMS Input; low distortion	Signal Injection	HP Part No. 9120-0049
RC Phase Shifter	Shift phase about 3.6° at at 4000 cps (100 VRMS)	Signal Injection	
Phase Standard (In place of RC Phase Shifter)	100 V Input and Output with a phase accuracy of .05% or better	Signal Injection	Dytronics 311
Test Cables	Straight through	Allow operation of Model 526D outside of counter	Ⓢ Part No. 524B-16P (16 pin) and 524B-16Q (8 pin)
Delay Generator	2.5 to 1250 μ sec delay, 0.02 μ sec jitter	In-Cabinet performance Check	Ⓢ Model 218A with 219B

c. After the above steps have been completed and normal operation is observed, apply the same signal to both the REFERENCE and UNKNOWN CHANNEL INPUT connectors. Set LAGS-LEADS switch to LAGS. Set TRIGGER LEVEL controls as described in paragraph 3-13, steps f, g, and h. Counter should indicate either a 0 or 360 degree phase angle, that is, it should display either 0 μ sec or 9999.9 μ sec.

5-7. SECTIONALIZATION (400 cps operation). If the Model 526D should operate unsatisfactorily only for 400 cps operation, the trouble may be in the multiplier section of the Model 526D. Proceed as follows to check the multipliers:

a. Supply a 400 cps signal to the REFERENCE CHANNEL INPUT connector. Set the UNKNOWN LAGS LEADS switch to LAGS. Set the PHASE PERIOD switch to PERIOD.

b. Connect a coaxial cable from the Model 526D TO STD FREQ. OUTPUT to the counter SIGNAL INPUT. Set the counter FUNCTION SELECTOR to FREQUENCY. The counter should indicate 1.44 mc if the input signal applied to the Model 526D is 400 cps. Vary the input signal to the Model 526D from 396 cps to 404 cps. The counter should indicate between 1.42560 and 1.45440 mc. If the counter indications are incorrect, troubleshoot the multipliers.

5-8. REPAIRS.

5-9. After the defective component has been located, remove power from the Model 526D. Then carefully remove the defective component. Do not over-heat the etched-circuit boards. When replacing power transistors or rectifiers, be careful that the thin mica insulating disc does not become broken or cracked.

5-10. ADJUSTMENTS.

5-11. REFERENCE AND UNKNOWN CHANNEL COARSE TRIGGER LEVEL ADJUSTMENTS.

5-12. Connect Model 526D to 524B/C/D using extender cables. To adjust the reference channel coarse trigger level, proceed as follows:

a. Set the REFERENCE CHANNEL INPUT VOLTAGE RANGE attenuator to the AC, 5-15 volt position.

b. Set the REFERENCE CHANNEL TRIGGER LEVEL control to mid-position.

c. Connect the oscilloscope to pin 2 of reference channel trigger unit (XA201). Apply a 0.1 volt rms, 400 cps sine wave to the REFERENCE CHANNEL INPUT connector. Adjust R204 (see figure 3-1) for symmetrical square wave. Then reduce the 400 cps input, while adjusting R204 for symmetrical square wave until the trigger unit will no longer trigger. Then apply a 15-volt rms, 400-cps sine wave. The oscilloscope display should be a symmetrical square wave. If the display is not symmetrical, repeat steps b and c.

d. To adjust the unknown channel coarse trigger level, proceed as follows:

e. Set the UNKNOWN CHANNEL INPUT VOLTAGE RANGE attenuator to the AC, 5-15 volt position.

f. Set the UNKNOWN CHANNEL TRIGGER LEVEL control to mid-position.

g. Connect the oscilloscope to pin 2 of unknown channel trigger unit (XA202). Apply a 0.1 volt rms 400 cps sine wave to the UNKNOWN CHANNEL INPUT connector. Adjust R207 (refer to figure 3-1) for symmetrical square wave. Then reduce the 400 cps input, while adjusting R207 for symmetrical square wave. If the display is not symmetrical repeat steps f and g.

5-13. INPUT ATTENUATOR ADJUSTMENTS.

5-14. The input attenuators may require adjustment when components are changed or aging of components becomes apparent. Connect Model 526D to 524B/C/D using extender cables. Allow 30 minutes to warm up if unit is cold.

5-15. Set both CHANNEL INPUT VOLTAGE RANGE to 5-15V AC. Set the L.C. meter to zero with the capacity switch in the 3 pf position and with the 9-in. cable (Φ 10502A) connected to L.C. meter. Turn capacity switch to 100 pf position and connect cable to REFERENCE CHANNEL of 526D. The TRIGGER LEVEL should be approximately centered. Adjust capacitor C201 to maximum capacity, then to indicate 70 pf $\pm$ 0.5 pf. Repeat the above for the UNKNOWN CHANNEL. Adjust capacitor C202 to indicate 70 pf $\pm$ 0.5 pf.

5-16. The input attenuators are adjusted at a frequency of 4000 cps using a stable phase shifter on one channel and a ratio transformer on the other channel. The INPUT VOLTAGE RANGE on both attenuators remains on the 5-15V AC range and the zero voltage trigger point on one channel is determined by reducing the input signal level by a factor of two using the ratio-transformer. Then the ratio-transformer and phase shifter are inter-changed to the inputs to determine the zero voltage trigger point on the other channel. This procedure allows the use of a stable phase shifter (about 3.6°) with unknown accuracy ($\pm$ 10%) to be measured on the 5-15V AC range. The counter reading (in microseconds) is the phase shift which is used to adjust all other attenuator positions.

Note

The noise and harmonic distortion must be 65db below the input signal amplitude for accurate adjustments of the attenuators.

5-17. Connect the equipment together as shown:

a. Set controls as follows:

A USE FIVE 10µf FIXED MYLAR
(HP PART NO. 0170-0025)

B STEP UP TRANSFORMER
(HP PART NO. 9120-0049)

C RATIO TRANSFORMER

D RC PHASE SHIFTER

E TO REF INPUT ON 526D

Note

Phase Shifter must use stable components to obtain a phase shift which remains constant. Use a polystyrene or Mylar capacitor and wire wound resistors.

C_1 - .27 µf, 10% 100WVDC Ⓢ Part No. 0160-0215

R_1 - 2000 ohm, 10 W WW Ⓢ Part No. 0816-0012

R_2 - 200 ohm, 1 W WW Ⓢ Part No. 0813-0022

INSTRUMENT	CONTROLS	SETTINGS
Sine Wave Generator	FREQUENCY REFERENCE PHASE AMPLITUDE SINE	4000 cps +4 cps Full clockwise
Amplifier	VAR. GAIN AMPLIFIER/SUPPLY	Full counter clockwise
AC VTVM	RANGE	100v
Ratio Transformer		0.15000
526D	REFERENCE VOLTAGE RANGE	5-15V AC
	UNKNOWN VOLTAGE RANGE	5-15V AC
	TRIGGER LEVEL	Centered-both channels
	UNKNOWN Switch	LAGS

A Phase Standard can be used in place of the RC Phase Shifter. The Phase Standard (if used) is adjusted for a phase shift of 3.6° at 4000 cps. Output voltage set for 15 volts (0.15000).

b. Adjust gain on amplifier to obtain 100 ±1 volt rms on AC VTVM.

c. Adjust the UNKNOWN CHANNEL TRIGGER LEVEL to obtain a zero voltage trigger point.

NOTE: Adjust the TRIGGER LEVEL control by noting the Counter indication, reduce the input amplitude by a factor of 2 by turning the Ratio Transformer to 0.07500. Note the direction and amount of change of Counter reading. Over correct this change by approximately 2 adjustments of the TRIGGER LEVEL control.

EXAMPLE: Original Counter indication 1300
Lower Voltage Indication 1320

d. With the lower voltage applied, adjust TRIGGER LEVEL control to get 1280. Change Ratio Transformer setting back to 0.15000. The Counter indication should not change. Repeat this process if necessary until no change in Counter indication occurs when Ratio Transformer settings are changed by factor of 2.

e. Leave the UNKNOWN CHANNEL TRIGGER LEVEL set and reverse the input leads so the Ratio Transformer is connected to the REFERENCE CHANNEL. Change the UNKNOWN switch to LEAD.

Table 5-2. Input Adjustments Using Ratio Transformer

Ratio Setting	Input Voltage	INPUT VOLTAGE RANGE	Switch To	Adjust Cap
.15000	.5V rms	5-15V AC	15-30V AC	C104
.30000	30 V rms	15-30V AC	30-60V AC	C107
.60000	60V rms	30-60V AC	60-120V AC	C110
1.00000	100V rms	60-120V AC	120-240V AC	C113

f. Adjust the REFERENCE CHANNEL TRIGGER LEVEL control for a zero voltage triggering point. Use the method just described. Set the Ratio Transformer to 0.15000 (15 rms). Switch REFERENCE CHANNEL INPUT VOLTAGE RANGE to 15-30V AC position. Adjust C104 on the attenuator to obtain the same Counter indication that was obtained in the 5-15V AC position. (See figure for capacitor location). The indication may change after capacitor is initially set so wait 1 minute and reset the capacitor if necessary. The indication on the two ranges should not differ more than 0.1 μ sec.

g. Set the INPUT VOLTAGE RANGE to 15-30V AC. Set Ratio Transformer to 0.30000 (30 volts). Adjust the TRIGGER LEVEL control for a zero voltage triggering point by setting Ratio Transformer to 0.150000 (15V rms). Set Ratio Transformer back to 0.30000. Set INPUT VOLTAGE RANGE to 30-60V AC. Adjust C107 on the attenuator to obtain the same Counter indication that was obtained on the next lower INPUT VOLTAGE RANGE. Repeat this procedure for the 60-120V AC and 120-240V AC. The settings are tabulated in Table 5-2.

h. Set Ratio Transformer to 0.15000. Set REFERENCE CHANNEL INPUT VOLTAGE RANGE to 5-15V AC. Set REFERENCE TRIGGER LEVEL for zero voltage trigger point. Switch input leads and connect Ratio Transformer to UNKNOWN CHANNEL. Set UNKNOWN switch to LAGS position. Adjust UNKNOWN attenuator capacitors as above. Disconnect leads from Ratio Transformer and Phase Shifter from 526D.

i. Set L.C. meter to read zero as in paragraph 5-15. Connect L.C. meter to UNKNOWN CHANNEL. Adjust C112 to obtain 70 pf $\pm$ 5 pf on 120-240V AC. Adjust the capacitors tabulated below to obtain 70 pf $\pm$ 0.5 pf input capacity on each range as in Table 5-3.

Table 5-3. Input Adjustments Using L. C. Meter

INPUT VOLTAGE RANGE	Capacitor No.
15-30V AC	C102
30-60V AC	C106
60-120V AC	C109
120-240V AC	C112

j. Disconnect L.C. meter from UNKNOWN CHANNEL. Reset L.C. meter to zero. Connect L.C. meter to REFERENCE CHANNEL and adjust input capacity to 70 pf $\pm$ 5 pf on 15-30V AC through 120-240V AC range as in Table 5-3.

5-18. UNKNOWN CHANNEL COARSE TRIGGER LEVEL ADJUSTMENT. To adjust the unknown channel coarse trigger level, proceed as follows:

a. Set the UNKNOWN CHANNEL INPUT VOLTAGE RANGE attenuator to the AC, 5-15 volt position.

b. Set the UNKNOWN CHANNEL TRIGGER LEVEL control to mid-position.

c. Connect the oscilloscope to pin 2 of unknown channel trigger unit (XA202). Apply a 0.1 volt rms, 400 cps sine wave to the UNKNOWN CHANNEL INPUT connector. Adjust R205 (refer to figure 3-1) for symmetrical square wave. Then reduce the 400 cps input, while adjusting R205 for symmetrical square wave until the trigger unit will no longer trigger. Then apply a 15-volt rms, 400-cps sine wave. The oscilloscope display should be a symmetrical square wave. If the display is not symmetrical, repeat steps b and c.

5-19. MULTIPLIER ADJUSTMENTS.

5-20. GENERAL. Set the Model 202C frequency to 400 cps; verify the frequency with the counter. Set the Model 526D REFERENCE CHANNEL INPUT VOLTAGE RANGE attenuator to the AC, 5-15 volt position. Set the output of the Model 202C to 5 volts rms. Connect the output of the 202C to the REFERENCE CHANNEL INPUT connector.

Note

The tuning adjustment of the following transformers and coils is broad; the tuning peak should be determined by varying the Model 202C frequency above and below 400 cps. Then adjust the transformer so the peak occurs at 400 cps $\pm$ 0.25 cps, with symmetrical bandpass before severe am distortion occurs.

5-21. 400 CPS AMPLIFIER AND DOUBLER. Connect the oscilloscope, using the 10:1 probe to one of the outside terminals of T301. Adjust T301 for maximum 400 cps indication.

5-22. 800 to 6400 CPS MULTIPLIER.

a. Connect the oscilloscope to one of the outside terminals of T302. Adjust T302 for maximum 800 cps indication.

b. Connect the oscilloscope to one of the outside terminals of T303. Adjust T303 for maximum 1600 cps indication.

c. Connect the oscilloscope to one of the outside terminals of T304. Adjust T304 for maximum 3200 cps indication.

d. Connect the oscilloscope to the junction of R331 and R332. Adjust L301 for maximum 6400 cps indication.

Note

Check to insure the bandwidth is symmetrical with respect to 400 cps and that the subharmonic components present are negligible.

5-23. 19.2 KC - 1.44 MC MULTIPLIER.

5-24. X3 MULTIPLIER (19.2 kc). Connect the oscilloscope to the junction of R335 (33K), R337 (560 Ω), R336 (3.9K). Adjust tuning slugs of T305 and L302 for maximum 19.2 kc voltage. These adjustments interact and must be repeated several times.

5-25. X3 MULTIPLIER (57.6 kc). Connect the oscilloscope to the junction of R339 (15K), R340 (3.9K). Adjust T306 and L303 for maximum 57.6 kc voltage. These adjustments interact and must be repeated several times.

5-26. X5 MULTIPLIER (288 kc). Connect the oscilloscope to the junction of R351 (15K), R352 (5.6K). Adjust T307 and L305 for maximum 288 kc voltage. These adjustments interact and must be repeated several times.

5-27. AMPLIFIER (288 kc). Connect the oscilloscope to the junction of R355 (15K), R356 (5.6K). Adjust T308 for maximum 288 kc voltage.

5-28. X5 MULTIPLIER (1.44 mc). Connect the oscilloscope to the junction of R361 (15K) and R362 (5.6K). Adjust T309 and L309 for maximum 1.44 mc voltage. These adjustments interact and must be repeated several times.

5-29. AMPLIFIER (1.44 mc). Connect the oscilloscope to the TO STD. FREQ. OUTPUT connector. Adjust L310 for maximum 1.44 mc voltage.

Note

Change the input frequency to determine overall bandwidth. The bandwidth should be symmetrical with respect to 1.44 mc bandwidth and without severe subharmonic distortion. Retune multiplier stages, if necessary, until output is satisfactory.

5-30. POWER SUPPLY (Regulators).

5-31. 6.3 VOLTS DC SUPPLY.

5-32. The 6.3 vdc is biased to -35 volts, thus must be measured with an ungrounded voltmeter. The voltage must be between 6.0 and 6.6 volts dc. Since there are no adjustments, parts substitution must be used to obtain the correct voltage.

5-33. 12-VOLT REGULATOR.

5-34. The 12-volt supply must be between 10.8 and 13.2 volts dc. There are no adjustments. If the voltage is not within limits, change CR203.

5-35. -112 VOLT SUPPLY.

5-36. The -112 volt supply must be between -110 and -115 volts dc. There are no adjustments. If the voltage is not within limits, change V201.

5-37. IN-CABINET PERFORMANCE CHECK.

5-38. After repairs have been made, or when the Model 526D is received, a check of the instrument specifications may be desired. Use a Phase Standard or the following paragraphs, 5-39 to 5-54 to check the Model 526D.

5-39. EQUIPMENT CONNECTIONS.

5-40. TEST CABLES. The test cables listed in table 5-1 enable operation of the Model 526D outside the counter. To perform an in-cabinet performance check, modification of the 8-pin test cable is required. Proceed as follows:

5-41. Remove the female connector of the 8-pin test cable. Unsolder the wire from pin 7 of the test cable. Solder a 4-foot piece of wire to pin 7. Splice and solder a 4-foot piece of wire to the wire removed from pin 7. Connect BNC connectors to the loose ends of the 4-foot wires. Replace the female connector on the test cable.

5-42. MODEL 218A CONNECTIONS. Connect the BNC connector on wire soldered to pin 7 of female 8-pin connector to Model 218A EXT INPUT connector. Connect the other BNC connector to PULSE GENERATOR B OUTPUT connector (located on Model 219B). Isolate power cable ground connection by installing an ungrounded 3-prong to 2-prong adapter (stock No. 1251-0048) at the power receptacle. Connect Model 218A chassis to Model 526D chassis using a short clip-lead.

5-43. MODEL 526D AND COUNTER CONNECTIONS. Connect Model 526D to the counter using the modified 8-pin connector and the 16-pin connector.

5-44. SIGNAL CONNECTIONS. Using Model 203C and a tee connector, connect output of the 203C to both the REFERENCE and UNKNOWN CHANNELS of Model 526D (in-phase signals). Refer to figure 5-1.

5-45. EQUIPMENT CONTROLS.

5-46. The following paragraphs describe the control settings for the first check. The remainder of the checks are listed in table 5-4.

5-47. MODEL 218A and 219B CONTROLS. Set the Model 218A and 219B controls as follows:

- a. Set T₁ red controls to 0001.0 μ sec.
Set T₂ black controls to 2000.0 μ sec.
- b. START PULSE SELECTOR to -EXT.

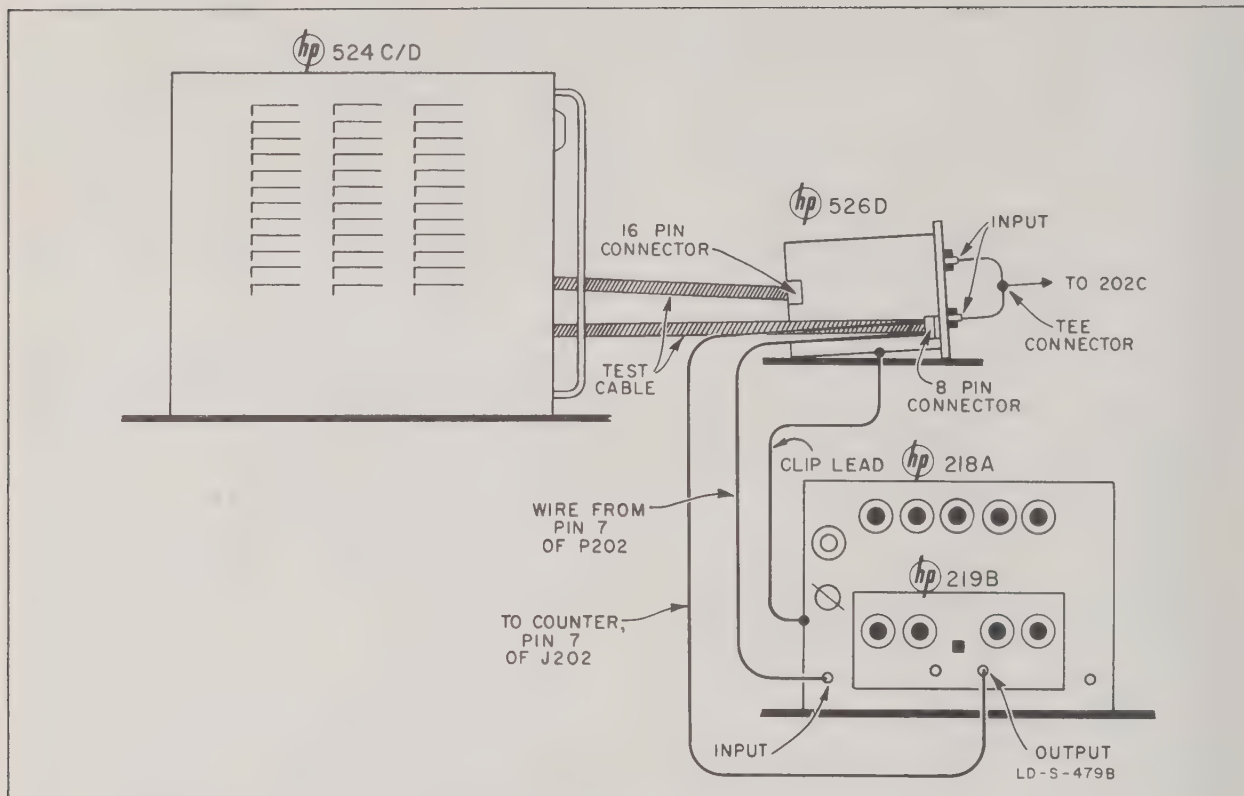


Figure 5-1. Equipment Connection for In-Cabinet Performance Check

c. PULSE GENERATOR B, WIDTH μ S full counter-clockwise (minimum width).

d. PULSE GENERATOR B, AMPLITUDE VOLTS to 10 and OUTPUT POLARITY to - (negative).

e. COMP-SEP switch to SEP.

5-48. MODEL 526D CONTROLS. Set Model 526D controls as follows:

a. INPUT VOLTAGE RANGE attenuators to 5-15 volts, dc coupled.

b. TRIGGER LEVEL to mid-position.

c. UNKNOWN LAGS-LEADS to UNKNOWN LAGS.

d. PHASE PERIOD to PHASE.

5-49. COUNTER CONTROLS. Set the counter controls as follows:

a. TIME UNITS to 10 MC.

b. FUNCTION SELECTOR to PERIOD.

c. DISPLAY TIME to minimum, or as desired.

5-50. OPERATING PROCEDURE.

5-51. Proceed as follows:

a. Apply power to equipment and allow 30 minutes warmup time. Monitor the output of Model 526D with 203C to 1 cycle per second with an output of 10 volts.

b. Adjust TRIGGER LEVEL control as stated in section III. After TRIGGER LEVEL controls are adjusted, the indication on the counter should be $2000 \mu\text{sec} \pm 1390 \mu\text{sec}$. If necessary, adjust TRIGGER LEVEL on Model 218A for stable counter indication. To check accuracy specification, total noise and distortion must be 65 db below input signal amplitude.

c. Repeat the above, using data in Table 5-4.

5-52. 400-CYCLE CHECK.

5-53. To check the 400-cycle operation, proceed as follows:

a. Set Model 203C to 400 cps at an output voltage of 10 volts.

b. Connect a short piece of coaxial cable between Model 526D TO STD. FREQ. OUTPUT and counter STD. FREQ. OUTPUT connectors.

d. Set Model 218A for a delay of 1250 sec.

e. Set the counter TIME UNIT switch to EXT.

f. Adjust Model 526D TRIGGER LEVEL controls as stated in section III. After trigger level is adjusted the counter indication is in degrees and should be $180.0^\circ \pm 0.8^\circ$.

g. Change Model 218A delay to 1262.6 μsec .

h. Change Model 203C output frequency to 396 cps. Counter should indicate $180.0^\circ \pm 0.8^\circ$.

Table 5-4. Start-Stop Trigger Check

1 Model 203C Frequency	2 Model 203C Output	3 Model 218A Delay	4 Model 526D Requirement	5 Counter Indication
1 cps	10 volts	2000.0 μ sec	Adjust trigger level as stated in section III ⁴	2000.0 μ sec $\pm$ 1390.0 μ s
10 cps	10 volts	500.0 μ sec		500.0 μ sec $\pm$ 140.0 μ sec
100 cps	10 volts	500.0 μ sec		500.0 μ sec $\pm$ 15.0 μ sec
1 kc	10 volts	500.0 μ sec		500.0 μ sec $\pm$ 2.6 μ sec ³
5 kc	10 volts	29.8 μ sec ²		30.0 μ sec $\pm$ 1.5 μ sec ³
10 kc	10 volts	29.8 μ sec ²		30.0 μ sec $\pm$ 1.4 μ sec ³
20 kc ¹	10 volts	29.8 μ sec ³		30.0 μ sec $\pm$ 1.3 μ sec ³

- Notes: (1) Φ 218A has a 10Kc limitation on repetition rate for external trigger. Lockout gate circuit should allow 20 Kc rate and jitter will not become excessively high for this test.
- (2) Delay between external input trigger and T_0 is about 0.2 μ sec. Therefore, total delay will be 30.0 μ s.
- (3) Includes ± 0.1 μ sec accuracy of Φ 218A.
- (4) Keep the INPUT VOLTAGE RANGE attenuators on 5-15 volts.

i. Change Model 218AR delay to 1237.6 μ sec.

j. Change Model 203C output to 404 cps. Counter should indicate $180.0^\circ \pm 0.8^\circ$.

5-54. ATTENUATOR CHECK.

5-55. To check the remainder of the INPUT VOLTAGE RANGE attenuators, proceed as follows:

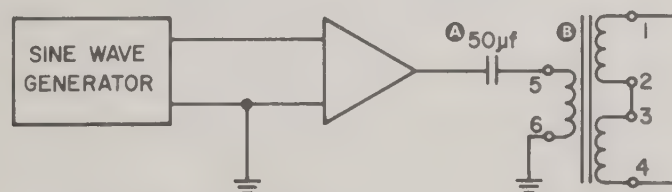
- a. Connect equipment as shown below.
- b. Set Model 526D INPUT VOLTAGE RANGE attenuators to the 15-30 volt range.

c. Set Model 203AG frequency to 5 kc, at an output voltage of 25 volts (monitor output with Model 400D).

d. Set Counter TIME UNIT switch to PERIOD.

e. Set Model 218A for a delay of 29.8 μ sec. Adjust Model 526D TRIGGER LEVEL controls as stated in section III. After the trigger level controls are adjusted, the counter indication should be 30.0 μ sec $\pm$ 1.5 μ sec.

f. Repeat the above, using input voltages to Model 526D of 40 volts on the 30-60 volt range, and 100 volts on the 60-120 volt range. The counter indication in each case should be 30.0 μ sec $\pm$ 1.5 μ sec.



Ⓐ USE FIVE 10 μ f FIXED MYLAR
(HP PART NO. 0170-0025)

Ⓑ STEP UP TRANSFORMER
(HP PART NO. 9120-0049)

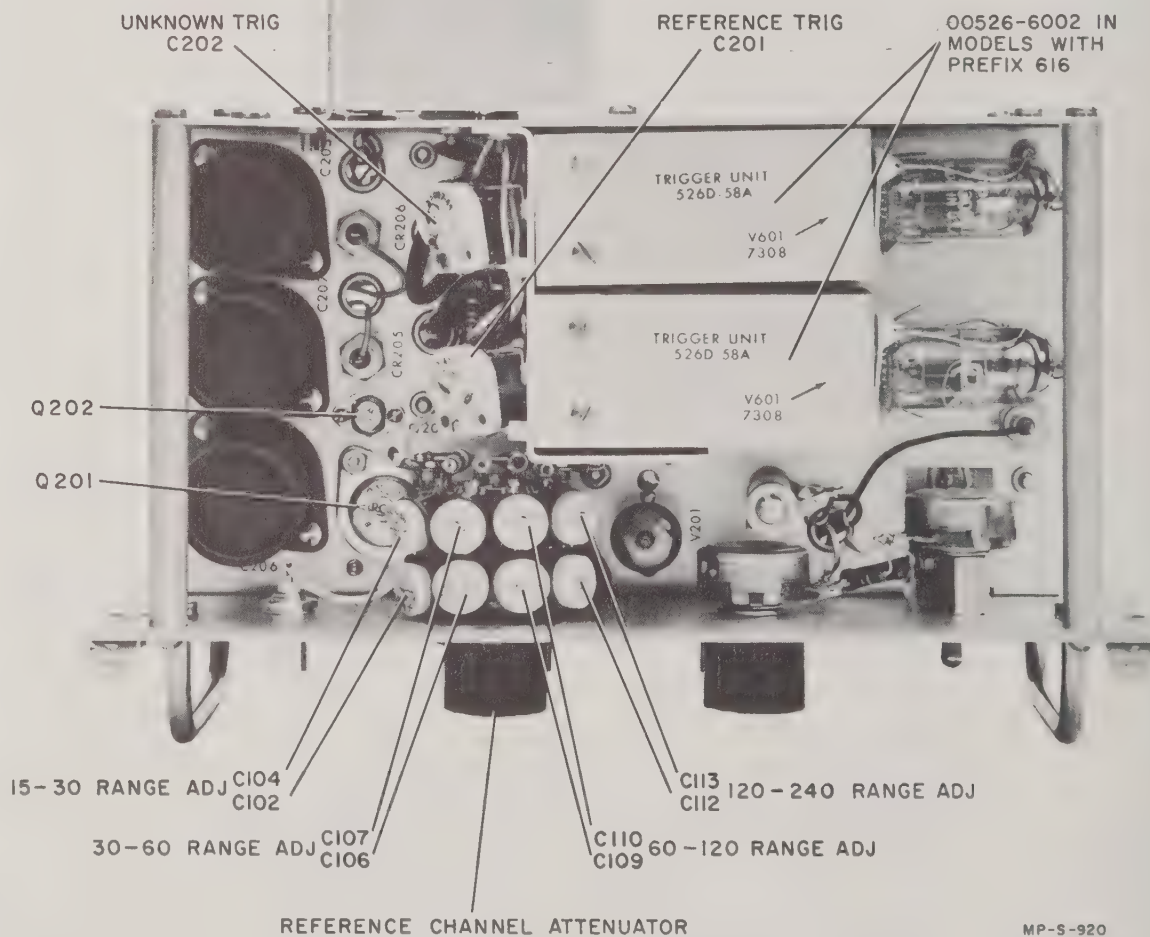


Figure 5-2. Top View Model 526D

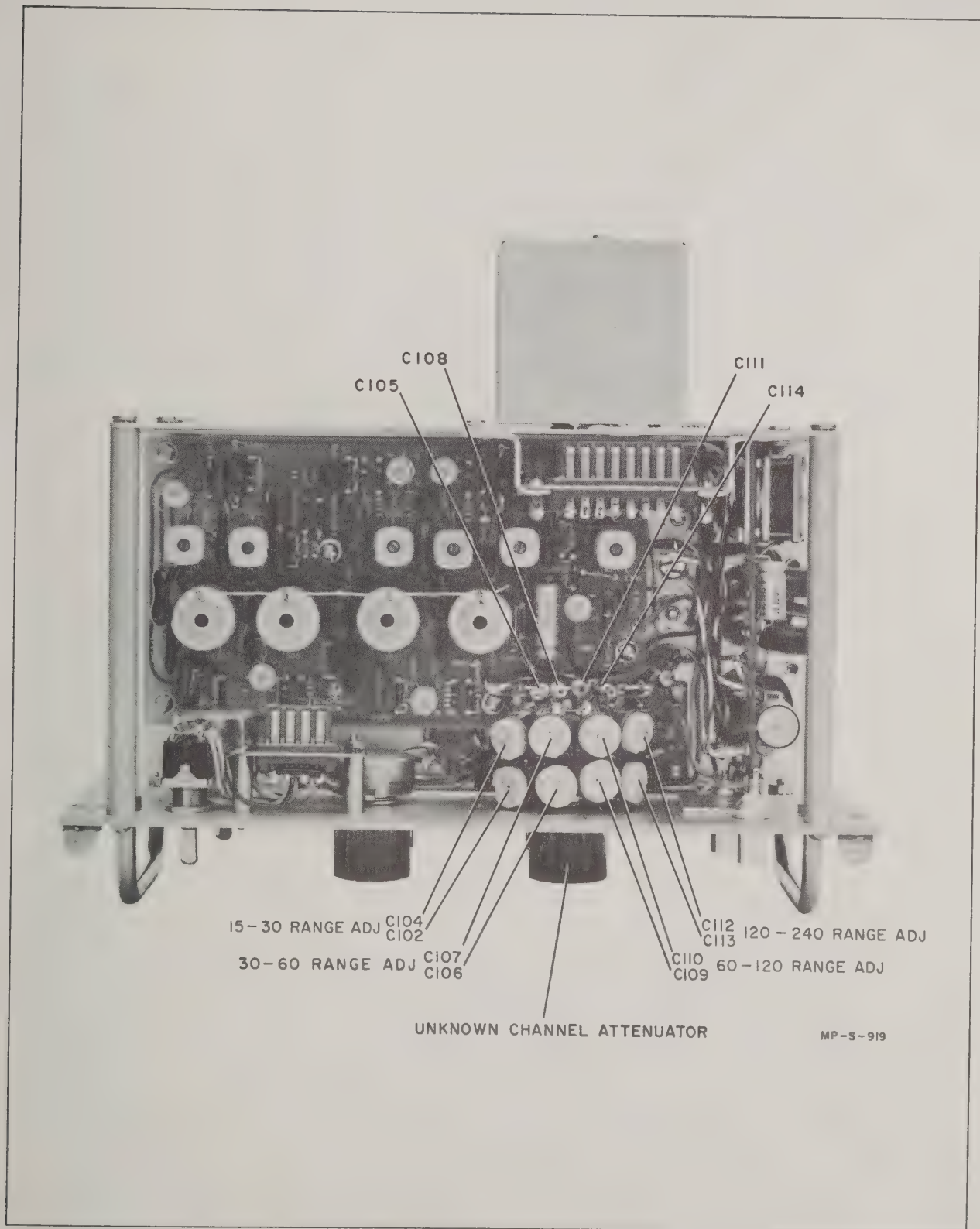
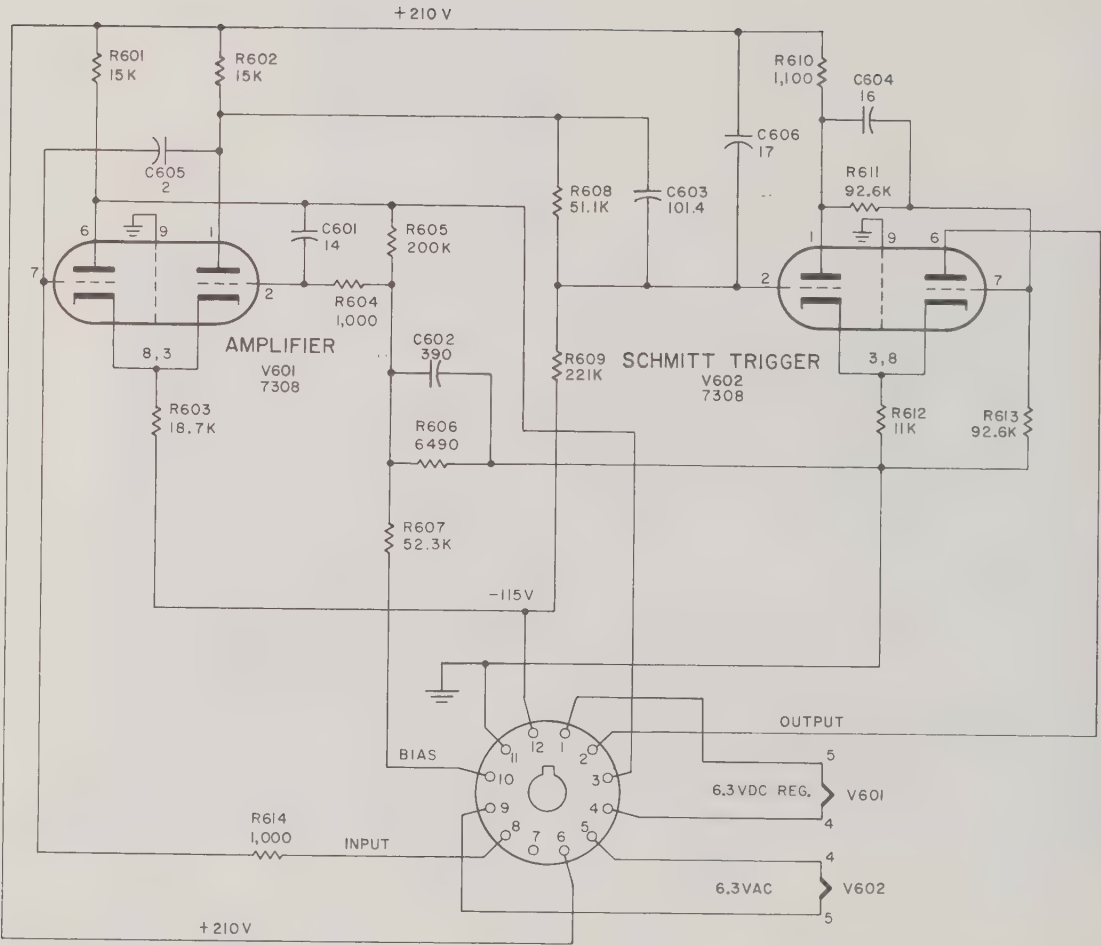


Figure 5-3. Bottom View Model 526D



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00526-6002-TRIG. UNIT-T117A

NOTES

UNLESS OTHERWISE STATED, CAPACITY IN pf, RESISTANCE IN OHMS.

REFERENCE DESIGNATORS

C601 - 606
R601 - 614
V601, 602

00526-0-7

Figure 5-4. Trigger Unit (526D-58A)

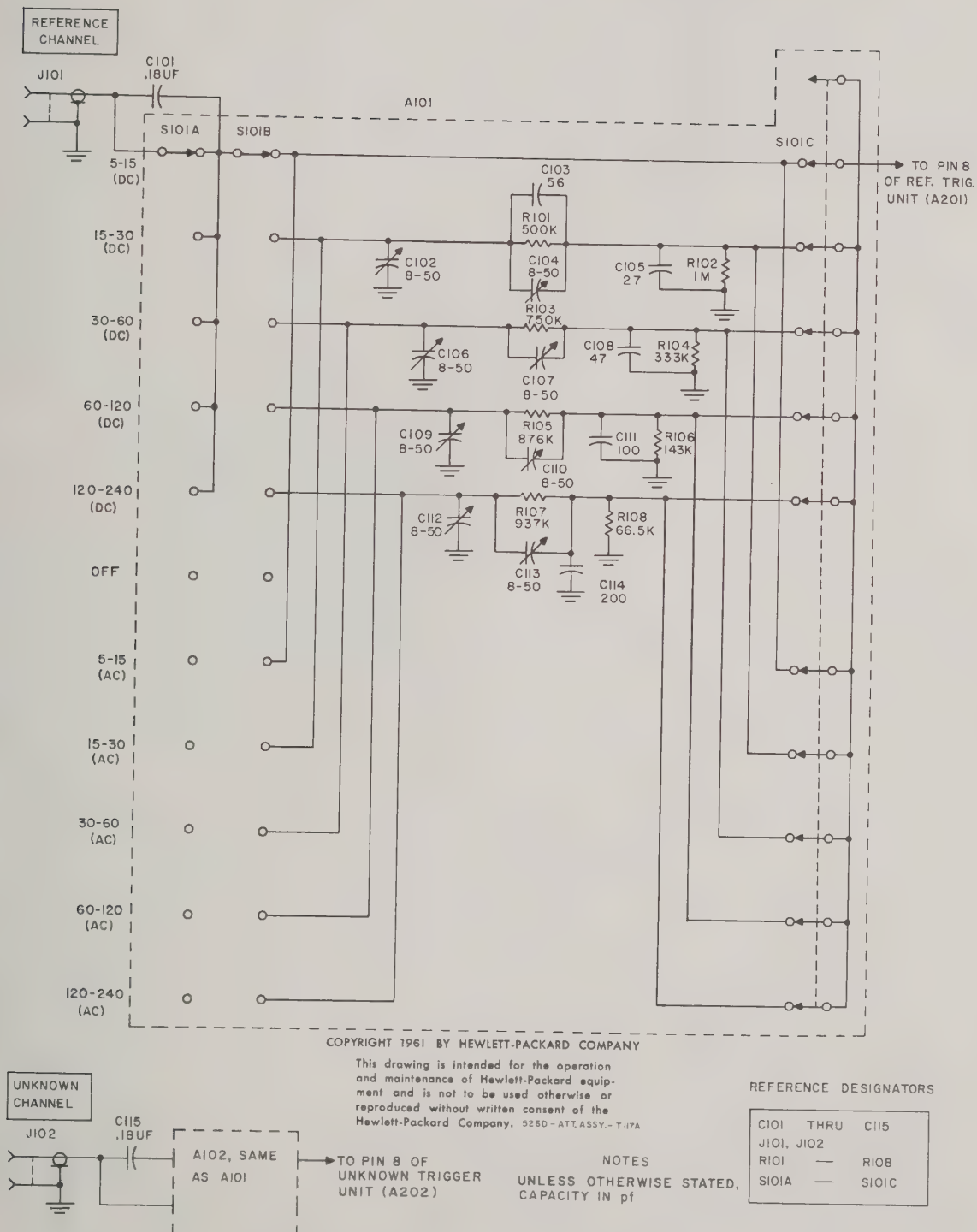
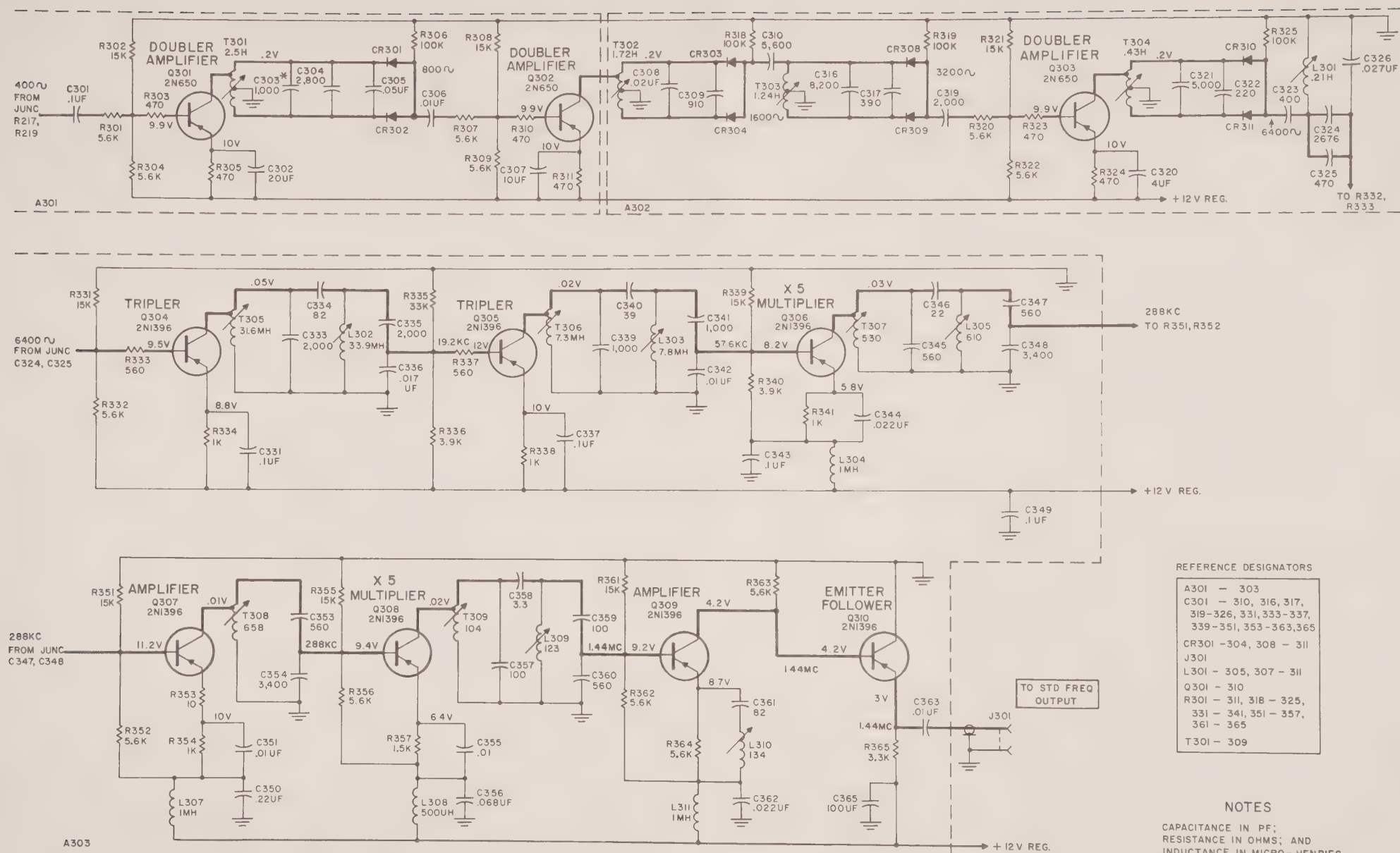


Figure 5-5. Attenuator Assembly





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NOTES

VOLTAGES MEASURED WITH VTVM
AND PHASE UNIT OPERATING WITH
400 c.p.s. SIGNAL.

Figure 5-7. Frequency Multiplier

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alpha-numerical order of their reference designators and indicates the description and HP stock number of each part, together with any applicable notes. Table 6-2 lists parts in alpha-numerical order of their HP stock number and provides the following information on each part;

- a. Description of the part (see list of abbreviations below).
- b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 6-3.
- c. Manufacturer's part number.
- d. Total quantity used in the instrument (TQ column).

6-3. Miscellaneous parts are listed at the end of Table 6-1.

6-4. ORDERING INFORMATION.

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard stock numbers.

6-6. To obtain a part that is not listed, include:

- a. Instrument model number.
- b. Instrument serial number.
- c. Description of the part.
- d. Function and location of the part.

REFERENCE DESIGNATORS

A = assembly	E = misc electronic part	P = plug	V = vacuum, tube, neon bulb, photocell, etc.
B = motor	F = fuse	Q = transistor	VR = voltage regulator
BT = battery	FL = filter	R = resistor	W = cable
C = capacitor	J = jack	RT = thermistor	X = socket
CP = coupler	K = relay	S = switch	Y = crystal
CR = diode	L = inductor	T = transformer	
DL = delay line	M = meter	TB = terminal board	
DS = device signaling (lamp)	MP = mechanical part	TP = test point	

ABBREVIATIONS

A = amperes	H = henries	NPN = negative-positive-negative	RMS = root-mean square
A. F. C. = automatic frequency control	HEX = hexagonal	NRFR = not recommended for field replacement	RWV = reverse working voltage
AMPL = amplifier	HG = mercury	NSR = not separately replaceable	S-B = slow-blow
B. F. O. = beat frequency oscillator	HR = hour(s)		SCR = screw
BE CU = beryllium copper	IF = intermediate freq		SE = selenium
BH = binder head	IMPG = impregnated		SECT = section(s)
BP = bandpass	INCD = incandescent		SEMICON = semiconductor
BRS = brass	INCL = include(s)	OBD = order by description	SI = silicon
BWO = backward wave oscillator	INS = insulation(ed)	OH = oval head	SIL = silver
	INT = internal	OX = oxide	SL = slide
CCW = counter-clockwise	K = kilo = 1000		SPG = spring
CER = ceramic	LH = left hand	P = peak	SPL = special
CMO = cabinet mount only	LIN = linear taper	PC = printed circuit	SST = stainless steel
COEF = coefficient	LK WASH = lock washer	PF = picofarads = 10 ⁻¹² farads	SR = split ring
COM = common	LOG = logarithmic taper	PH BRZ = phosphor bronze	STL = steel
COMP = composition	LPF = low pass filter	PHL = Phillips	TA = tantalum
COMPL = complete	M = milli = 10 ⁻³	PIV = peak inverse voltage	TD = time delay
CONN = connector	MEG = meg = 10 ⁶	PNP = positive-negative-positive	TGL = toggle
CP = cadmium plate	MET FLM = metal film	P/O = part of	THD = thread
CRT = cathode-ray tube	MET OX = metallic oxide	POLY = polystyrene	TI = titanium
CW = clockwise	MFR = manufacturer	PORC = porcelain	TOL = tolerance
DEPC = deposited carbon	MINAT = miniature	POS = position(s)	TRIM = trimmer
DR = drive	MOM = momentary	POT = potentiometer	TWT = traveling wave tube
ELECT = electrolytic	MTG = mounting	PP = peak-to-peak	
ENCAP = encapsulated	MY = "mylar"	PT = point	U = micro = 10 ⁻⁶
EXT = external		PWV = peak working voltage	VAR = variable
F = farads	N = nano (10 ⁻⁹)		VDCW = dc working volts
FH = flat head	N/C = normally closed		W/ = with
FIL H = fillister head	NE = neon	RECT = rectifier	W = watts
FXD = fixed	NI PL = nickel plate	RF = radio frequency	WIV = working inverse voltage
GE = germanium	N/O = normally open	RH = round head or right hand	WW = wirewound
GL = glass	NPO = negative positive zero (zero temperature coefficient)	RMO = rack mount only	W/O = without
GRD = ground(ed)			

Table 6-1. Reference Designation Index

Circuit Reference	Stock No.	Description	Note
A1 thru A100		Not assigned	
A101, 102	526D-34A	Assy, attenuator: includes, C102 thru C114 R101 thru R108 S101	
A103 thru A200		Not assigned	
A201, 202	526D-58A	Assy, trigger unit: includes, C601 thru C604 V601 XV601 R601 thru R614 V602 XV602	
A203 thru A300		Not assigned	
A301	526D-65A	Assy, circuit: 400 cps, includes, C301 thru C307 CR302 Q302 T301 CR301 Q301 R301 thru R311	
A302	526D-65B	Assy, circuit: 800 cps to 6400 cps, includes: C308 thru C310 C319 thru C326 CR308 thru CR311 C316 CR303 Q303 C317 CR304 R318 thru R325	
A303	526D-65C	Assy, circuit: 19.2KC to 1.44 MC, includes, C332 thru C337 L302 thru L305 R351 thru R357 C339 thru C349 L307 thru L311 R361 thru R365 C351 thru C363 Q304 thru Q310 T305 thru T309 C365 R331 thru R341	
C1 thru C100		Not assigned	
C101	0170-0033	C: fxd, my, 0.18 μ f $\pm 2\%$, 600 vdcw	
C102	0130-0008	C: var, cer, 8-50 pf	
C103	0140-0014	C: fxd, mica, 56 pf $\pm 10\%$, 500 vdcw	
C104	0130-0008	C: var, cer, 8-50 pf	
C105	0150-0115	C: fxd, cer, 27 pf $\pm 10\%$, 500 vdcw	
C106, 107	0130-0008	C: var, cer, 8-50 pf	
C108	0150-0116	C: fxd, cer, 47 pf $\pm 10\%$, 500 vdcw	
C109, 110	0130-0008	C: var, cer, 8-50 pf	
C111	0150-0117	C: fxd, cer, 100 pf $\pm 10\%$, 500 vdcw	
C112, 113	0130-0008	C: var, cer, 8-50 pf	
C114	0150-0118	C: fxd, cer, 200 pf $\pm 10\%$, 500 vdcw	
C115	0170-0033	C: fxd, my, 0.18 μ f $\pm 2\%$, 600 vdcw	
C116 thru C200		Not assigned	
C201, 202	0130-0001	C: var, cer, 7-45 pf, 500 vdcw	
C203, 204	0150-0012	C: fxd, cer, 0.01 μ f $\pm 20\%$, 1000 vdcw	
C205	0180-0011	C: fxd, elect, 20 μ f, 450 vdcw	
C206, 207	0180-0054	C: fxd, elect, 1.5K μ f, 10 vdcw	
C208 thru C300		Not assigned	
C301	0170-0022	C: fxd, my, 0.1 μ f $\pm 20\%$, 600 vdcw	
C302	0180-0045	C: fxd, elect, 20 μ f, 25 vdcw	
C303	0140-0179	C: fxd, mica, 1K* pf $\pm 2\%$, 300 vdcw	

See introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Circuit Reference	Ⓕ Stock No.	Description	Note
C304	0150-0114	C: fxd, cer, 2.8K pf $\pm 5\%$, 300 vdcw	
C305	0140-0188	C: fxd, mica, 0.05 μ f $\pm 1\%$, 300 vdcw	
C306	0140-0185	C: fxd, mica, 0.01 μ f $\pm 5\%$, 100 vdcw	
C307	0180-0089	C: fxd, elect, 10 μ f + 100% -10%, 150 vdcw	
C308	0140-0186	C: fxd, mica, 0.02 μ f $\pm 1\%$, 300 vdcw	
C309	0150-0113	C: fxd, cer, 910 pf $\pm 5\%$, 300 vdcw	
C310	0140-0183	C: fxd, mica, 5.6K pf $\pm 1\%$, 300 vdcw	
C311 thru C315		Not assigned	
C316	0140-0184	C: fxd, mica, 8.2K pf $\pm 1\%$, 100 vdcw	
C317	0150-0112	C: fxd, cer, 390 pf $\pm 5\%$, 300 vdcw	
C318		Not assigned	
C319	0140-0180	C: fxd, mica, 2K pf $\pm 2\%$, 300 vdcw	
C320	0180-0114	C: fxd, elect, 4 μ f + 100% -10%, 25 vdcw	
C321	0140-0182	C: fxd, mica, 5K pf $\pm 2\%$, 300 vdcw	
C322	0150-0111	C: fxd, cer, 220 pf $\pm 5\%$, 300 vdcw	
C323	0140-0177	C: fxd, mica, 400 pf $\pm 1\%$, 300 vdcw	
C324	0140-0158	C: fxd, mica, 2676 pf $\pm 1\%$, 500 vdcw	
C325	0150-0110	C: fxd, cer, 470 pf $\pm 5\%$, 300 vdcw	
C326	0140-0187	C: fxd, mica, 0.027 μ f $\pm 5\%$, 100 vdcw	
C327 thru C330		Not assigned	
C331	0170-0085	C: fxd, my, 0.1 μ f $\pm 20\%$, 50 vdcw	
C332		Not assigned	
C333	0140-0180	C: fxd, mica, 2K pf $\pm 2\%$, 300 vdcw	
C334	0140-0146	C: fxd, mica, 82 pf $\pm 5\%$, 300 vdcw	
C335	0140-0180	C: fxd, mica, 2K pf $\pm 2\%$, 300 vdcw	
C336	0140-0166	C: fxd, mica, 0.017 μ f $\pm 2\%$, 300 vdcw	
C337	0170-0085	C: fxd, my, 0.1 μ f $\pm 20\%$, 50 vdcw	
C338		Not assigned	
C339	0140-0179	C: fxd, mica, 1K pf $\pm 2\%$, 300 vdcw	
C340	0140-0175	C: fxd, mica, 39 pf $\pm 2\%$, 300 vdcw	
C341	0140-0179	C: fxd, mica, 1K pf $\pm 2\%$, 300 vdcw	
C342	0140-0185	C: fxd, mica, 0.01 μ f $\pm 5\%$, 100 vdcw	
C343	0170-0085	C: fxd, my, 0.1 μ f $\pm 20\%$, 50 vdcw	
C344	0170-0083	C: fxd, my, 0.022 μ f $\pm 20\%$, 50 vdcw	
C345	0140-0178	C: fxd, mica, 560 pf $\pm 2\%$, 300 vdcw	
C346	0140-0145	C: fxd, mica, 22pf $\pm 5\%$, 500 vdcw	
C347	0140-0178	C: fxd, mica, 560 pf $\pm 2\%$, 300 vdcw	
C348	0140-0160	C: fxd, mica, 3.4K pf $\pm 5\%$, 500 vdcw	
C349	0170-0085	C: fxd, my, 0.1 μ f $\pm 20\%$, 50 vdcw	

See introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Circuit Reference	Stock No.	Description	Note
C350	0170-0086	C: fxd, my, 0.1 μ f $\pm$ 20%, 50 vdcw	
C351	0170-0082	C: fxd, my, 0.01 μ f $\pm$ 20%, 50 vdcw	
C352		Not assigned	
C353	0140-0178	C: fxd, mica, 560 pf $\pm$ 2%, 300 vdcw	
C354	0140-0160	C: fxd, mica, 3.4K pf $\pm$ 5%, 500 vdcw	
C355	0170-0082	C: fxd, my, 0.01 μ f $\pm$ 20%, 50 vdcw	
C356	0170-0084	C: fxd, my, 0.068 μ f $\pm$ 20%, 50 vdcw	
C357	0140-0176	C: fxd, mica, 100 pf $\pm$ 2%, 300 vdcw	
C358	0150-0022	C: fxd, TiO ₂ , 3.3 pf $\pm$ 10%, 500 vdcw	
C359	0140-0176	C: fxd, mica, 100 pf $\pm$ 2%, 300 vdcw	
C360	0140-0178	C: fxd, mica, 560 pf $\pm$ 2%, 300 vdcw	
C361	0140-0146	C: fxd, mica, 82 pf $\pm$ 5%, 300 vdcw	
C362	0170-0083	C: fxd, my, 0.022 μ f $\pm$ 20%, 50 vdcw	
C363	0170-0082	C: fxd, my, 0.01 μ f $\pm$ 20%, 50 vdcw	
C364		Not assigned	
C365	0180-0061	C: fxd, elect, 100 μ f + 100% -10%, 15 vdcw	
C366 thru C600		Not assigned	
C601	0150-0056	C: fxd, cer, 14 pf $\pm$ 3%, 500 vdcw	
C602	0140-0037	C: fxd, mica, 390 pf $\pm$ 5%, 500 vdcw	
C603	0140-0111	C: fxd, mica, 101.4 pf $\pm$ 5%, 500 vdcw	
C604	0150-0057	C: fxd, cer, 16 pf $\pm$ 3%, 500 vdcw	
C605	0150-0031	C: fxd, TI Diox 2 pf 5%, 500 vdcw	
C606	0160-0360	C: fxd, cer 120 pf 5%, 500 vdcw	
CR1 thru CR200		Not assigned	
CR201, 202	1910-0011	Diode, Ge: type HD-2135A-5	
CR203	1902-0002	Diode, Si: 1N1594	
CR204	1902-0052	Diode, Si	
CR205, 206	1901-0013	Diode, Si: 1N253	
CR207 thru CR300		Not assigned	
CR301 thru CR304	1910-0003	Diode, Ge: 1N55A	
CR305 thru CR307		Not assigned	
CR308, 309	1910-0011	Diode, Ge: type HD-2135A-5	
CR310, 311	1910-0003	Diode, Ge: 1N55A	
J1 thru J100		Not assigned	
J101	1250-0083	Connector, female: BNC, type UG-1094/U	
J102	1250-0118	Connector, female: BNC, type UG-1094A/U	
J103 thru J300		Not assigned	
J301	1250-0083	Connector, female: BNC, type UG-1094/U	
L1 thru L200		Not assigned	
L201, 202	9140-0109	Inductor, fxd: 280 μ h	

See introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Circuit Reference	Stock No.	Description	Note
L203 thru L300		Not assigned	
L301	526D-60E	Inductor, var: 0.21 h	
L302	526D-60G	Inductor, var: 33.9 mh, 19.2 KC	
L303	526D-60J	Inductor, var: 7.8 mh	
L304	9140-0053	Inductor, fxd: 1 mh, 57.6 KC	
L305	526D-60L	Inductor, var: 610 μ h, 288 KC	
L306		Not assigned	
L307	9140-0053	Inductor, fxd: 1 mh	
L308	9140-0022	Inductor, fxd: 500 μ h	
L309	526D-60P	Inductor, var: 123 μ h, 1.44 MC	
L310	526D-60Q	Inductor, var: 134 μ h, 1.44 MC	
L311	9140-0053	Inductor, fxd: 1 mh	
P1 thru P200		Not assigned	
P201	1251-0006	Connector, male: 16 pin	
P202	1251-0008	Connector, male: 8 pin	
Q1 thru Q200		Not assigned	
Q201	1850-0094	Transistor: 2N1360	
Q202	1850-0048	Transistor: 2N650	
Q203 thru Q300		Not assigned	
Q301 thru Q303	1850-0048	Transistor: 2N650	
Q304 thru Q310	1850-0074	Transistor: 2N1396	
R101	0727-0244	R: fxd, dep c, 500K ohms $\pm 1\%$, 1/2 W	
R102	0727-0274	R: fxd, dep c, 1M $\pm 1\%$, 1/2 W	
R103	0727-0254	R: fxd, dep c, 750K ohms $\pm 1\%$, 1/2 W	
R104	0727-0233	R: fxd, dep c, 333K ohms $\pm 1\%$, 1/2 W	
R105	0721-0018	R: fxd, dep c, 876K ohms $\pm 1\%$, 1/8 W	
R106	0721-0017	R: fxd, dep c, 143K ohms $\pm 1\%$, 1/8 W	
R107	0721-0019	R: fxd, dep c, 937K ohms $\pm 1\%$, 1/8 W	
R108	0721-0016	R: fxd, dep c, 66.5K ohms $\pm 1\%$, 1/8 W	
R109 thru R200		Not assigned	
R201	2100-0184	R: var, comp, lin, 250K ohms $\pm 10\%$, 2 W	
R202	0686-8235	R: fxd, comp, 82K ohms $\pm 5\%$, 1/2 W	
R203	0727-0203	R: fxd, dep c, 90K ohms $\pm 1\%$, 1/2 W	
R204	2100-0278	R: var, comp, lin, 50K ohms $\pm 10\%$, 2 W	
R205	2100-0184	R: var, comp, lin, 250K ohms $\pm 10\%$, 2 W	
R206	0686-8235	R: fxd, comp, 82K ohms $\pm 5\%$, 1/2 W	
R207	2100-0278	R: var, comp, lin, 50K ohms $\pm 10\%$ 2 W	
R208	0727-0204	R: fxd, dep c, 90K ohms $\pm 1\%$, 1/2 W	

See introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Circuit Reference	@ Stock No.	Description	Note
R209, 210	0727-0274	R: fxd, dep c, 1M $\pm 1\%$, 1/2 W	
R211 thru R215		Not assigned	
R216	0687-1821	R: fxd, comp, 1.8K ohms $\pm 10\%$, 1/2 W	
R217	0687-1521	R: fxd, comp, 1.5K ohms $\pm 10\%$, 1/2 W	
R218	0819-0015	R: fxd, ww, 3K ohms $\pm 10\%$, 20 W	
R219	0687-3311	R: fxd, comp, 330 ohms $\pm 10\%$, 1/2 W	
R220	0686-1315	R: fxd, comp, 130 ohms $\pm 5\%$, 1/2 W	
R221	0687-6801	R: fxd, comp, 68 ohms $\pm 10\%$, 1/2 W	
R222	0687-2231	R: fxd, comp, 22K ohms $\pm 10\%$, 1/2 W	
R223 thru R300		Not assigned	
R301	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R302	0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	
R303	0684-4711	R: fxd, comp, 470 ohms $\pm 10\%$, 1/4 W	
R304	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R305	0684-4711	R: fxd, comp, 470 ohms $\pm 10\%$, 1/4 W	
R306	0684-1041	R: fxd, comp, 100K ohms $\pm 10\%$, 1/4 W	
R307	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R308	0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	
R309	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R310, 311	0684-4711	R: fxd, comp, 470 ohms $\pm 10\%$, 1/4 W	
R312 thru R317		Not assigned	
R318, 319	0684-1041	R: fxd, comp, 100K ohms $\pm 10\%$, 1/4 W	
R320	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R321	0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	
R322	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R323, 324	0684-4711	R: fxd, comp, 470 ohms $\pm 10\%$, 1/4 W	
R325	0684-1041	R: fxd, comp, 100K ohms $\pm 10\%$, 1/4 W	
R326 thru R330		Not assigned	
R331	0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	
R332	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R333	0684-5611	R: fxd, comp, 560 ohms $\pm 10\%$, 1/4 W	
R334	0684-1021	R: fxd, comp, 1K ohms $\pm 10\%$, 1/4 W	
R335	0684-3331	R: fxd, comp, 33K ohms $\pm 10\%$, 1/4 W	
R336	0684-3921	R: fxd, comp, 3.9K ohms $\pm 10\%$, 1/4 W	
R337	0684-5611	R: fxd, comp, 560 ohms $\pm 10\%$, 1/4 W	
R338	0684-1021	R: fxd, comp, 1K ohms $\pm 10\%$, 1/4 W	
R339	0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	
R340	0684-3921	R: fxd, comp, 3.9K ohms $\pm 10\%$, 1/4 W	
R341	0684-1021	R: fxd, comp, 1K ohms $\pm 10\%$, 1/4 W	

* See introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Circuit Reference	Ⓢ Stock No.	Description	Note
R342 thru R350		Not assigned	
R351	0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	
R352	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R353	0684-1001	R: fxd, comp, 10 ohms $\pm 10\%$, 1/4 W	
R354	0684-1021	R: fxd, comp, 1K ohms $\pm 10\%$, 1/4 W	
R355	0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	
R356	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R357	0684-1521	R: fxd, comp, 1.5K ohms $\pm 10\%$, 1/4 W	
R358 thru R360		Not assigned	
R361	0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	
R362 thru R364	0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	
R365	0687-3321	R: fxd, comp, 3.3K ohms $\pm 10\%$, 1/2 W	
R366 thru R600		Not assigned	
R601, 602	0767-0010	R: fxd, mfg, 15K ohms $\pm 5\%$, 3 W	
R603	0760-0003	R: fxd, mfg, 18.7K ohms $\pm 2\%$, 1 W	
R604	0686-1025	R: fxd, comp, 1K ohms $\pm 5\%$, 1/2 W	
R605	0727-0221	R: fxd, dep c, 200K ohms $\pm 1\%$, 1/2 W	
R606	0727-0143	R: fxd, dep c, 6490 ohms $\pm 1\%$, 1/2 W	
R607	0698-3143	R: fxd met flm 52.3K ohm 1%, 1/4 W	
R608	0757-0769	R: fxd met flm 51.1K ohm 1%, 1/4 W	
R609	0757-0783	R: fxd met flm 221K ohm 1%, 1/4 W	
R610	0757-0733	R: fxd met flm 1100 ohm 1%, 1/4 W	
R611	0727-0205	R: fxd, dep c, 92.6K ohms $\pm 1\%$, 1/2 W	
R612	0692-1135	R: fxd, comp, 11K ohms $\pm 5\%$, 2 W	
R613	0727-0205	R: fxd, dep c, 92.6K ohms $\pm 1\%$, 1/2 W	
R614	0687-1021	R: fxd, comp, 1K ohms $\pm 10\%$, 1/2 W	
S1 thru S100		Not Assigned	
S101	3100-0278	Switch, rot: 2 sect, 11 pos	
S102 thru S200		Not Assigned	
S201, 202	3101-0038	Switch, tog: DPDT	
T1 thru T300		Not Assigned	
T301	526D-60A	Transformer, var: tapped, 2.5 h	
T302	526D-60B	Transformer, var: tapped, 1.72 h	
T303	526D-60C	Transformer, var: tapped, 1.24 h	
T304	526D-60D	Transformer, var: tapped, 0.43 h	
T305	526D-60F	Transformer, var: tapped, 31.6 mh, 19.2KC	
T306	526D-60H	Transformer, var: tapped, 7.3 mh, 57.6KC	
T307	526D-60K	Transformer, var: tapped, 530 μ h, 288KC	
T308	526D-60M	Transformer, var: tapped, 658 μ h, 288KC	

See introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Circuit Reference	Ⓢ Stock No.	Description	Note
T309	526D-60N	Transformer, var: tapped, 104 μ h, 1.44MC	
V1 thru V200		Not Assigned	
V201	1940-0010	Tube, elect: OG3	
V202 thru V600		Not Assigned	
V601	1932-0032	Tube, elect: 7308	
V602	1932-0032	Tube, elect: 7308	
XA1 thru XA200		Not Assigned	
XA201, 202	1200-0038	Socket: 12 pin	
XQ2 thru XQ200		Not Assigned	
XQ201	1200-0061	Socket, power transistor	
XQ202	1200-0054	Socket, transistor: 4 pin	
XV1 thru XV200		Not Assigned	
XV201	1200-0009	Socket, tube: 7 pin	
XV202 thru XV600		Not Assigned	
XV601, 602	1200-0008	Socket, tube: 9 pin	
		<u>MISCELLANEOUS</u>	
	0370-0029	Knob; black: 1" w/arrow TRIGGER LEVEL	
	526D-74A	Knob: INPUT VOLTAGE RANGE	

See introduction to this section

Table 6-2. Replaceable Parts

Stock No.	Description	Mfr.	Mfr. Part No.	TQ			
526D-34A	Assy, attenuator: (includes C102 thru C114 S101) R101 thru R108	28480	526D-34A	2			
00526-6002	Assy, trigger unit: (includes C601 thru C606 V601 XV601 R601 thru R614 V602 XV602)	28480	00526-6002	2			
526D-60A	Transformer, var: tapped, 2.5 h	28480	526D-60A	1			
526D-60B	Transformer, var: tapped, 1.72 h	28480	526D-60B	1			
526D-60C	Transformer, var: tapped, 1.24 h	28480	526D-60C	1			
526D-60D	Transformer, var: tapped, 0.43 h	28480	526D-60D	1			
526D-60E	Inductor, var: 0.21 h	28480	526D-60E	1			
526D-60F	Transformer, var: tapped, 31.6 mh, 19.2KC	28480	526D-60F	1			
526D-60G	Inductor, var: 33.9 mh, 19.2KC	28480	526D-60G	1			
526D-60H	Transformer, var: tapped, 7.3 mh, 57.6KC	28480	526D-60H	1			
526D-60J	Inductor, var: 7.8 mh, 57.6KC	28480	526D-60J	1			
526D-60K	Transformer, var: tapped, 530 μ h, 288KC	28480	526D-60K	1			
526D-60L	Inductor, var: 610 μ h, 288KC	28480	526D-60L	1			
526D-60M	Transformer, var: tapped, 658 μ h, 288KC	28480	526D-60M	1			
526D-60N	Transformer, var: Tapped, 104 μ h, 1.44MC	28480	526D-60N	1			
526D-60P	Inductor, var: 123 μ h, 1.44MC	28480	526D-60P	1			
526D-60Q	Inductor, var: 134 μ h, 1.44MC	28480	526D-60Q	1			
526D-65A	Assy circuit: 400 cps (includes C301 thru C307 Q301 R301 thru R311 CR302 Q302 T301) R301	28480	526D-65A	1			
526D-65B	Assy, circuit: 800 cps to 6400 cps (includes C308 thru C310 CR304 C316 CR308 thru CR311 C317 Q303 C319 thru C326 R318 thru R325) CR303	28480	526D-65B	1			
526D-65C	Assy, circuit: 19.2KC to 1.44MC, (includes C332 thru C337 Q304 thru Q310 C339 thru C349 R331 thru R341 C351 thru C363 R351 thru R357 C365 R361 thru R365 L302 thru L305 T305 thru T309) L307 thru L311	28480	526D-65C	1			
0130-0001	C: var, cer, 7-45 pf, 500 vdcw	72982	503-000-D2PO-33R	2			
0130-0008	C: var, cer, 8-50 pf	72982	557-023-U2PO-34R	16			
0140-0014	C: fxd, mica, 56 pf $\pm$ 10%, 500 vdcw	76433	RCM15B560K	2			
0140-0037	C: fxd, mica, 390 pf $\pm$ 5%, 500 vdcw	76433	RCM15E391J	2			

See introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

Stock No.	Description	Mfr.	Mfr. Part No.	TQ			
0140-0145	C: fxd, mica, 22 pf $\pm 5\%$, 500 vdcw	72136	DM15F220J	1			
0140-0146	C: fxd, mica, 82 pf $\pm 5\%$, 300 vdcw	72136	DM15F820J	2			
0140-0158	C: fxd, mica, 2676 pf $\pm 1\%$, 500 vdcw	72136	DM20F2676F	1			
0140-0160	C: fxd, mica, 3.4K pf $\pm 5\%$, 500 vdcw	72136	DM20F342J	2			
0140-0166	C: fxd, mica, 0.017 μ f $\pm 2\%$, 300 vdcw	72136	DM30F173G	1			
0140-0175	C: fxd, mica, 39 pf $\pm 2\%$, 300 vdcw	72136	DM15E390G(300V)	1			
0140-0176	C: fxd, mica, 100 pf $\pm 2\%$, 300 vdcw	72136	DM15F101G(300V)	2			
0140-0177	C: fxd, mica, 400 pf $\pm 1\%$, 300 vdcw	72136	DM15F401F(300V)	1			
0140-0178	C: fxd, mica, 560 pf $\pm 2\%$, 300 vdcw	72136	DM15F561G(300V)	4			
0140-0179	C: fxd, mica, 1K pf $\pm 2\%$, 300 vdcw	72136	DM19F102G(300V)	3			
0140-0180	C: fxd, mica, 2K pf $\pm 2\%$, 300 vdcw	72136	DM19F202G(300V)	3			
0140-0182	C: fxd, mica, 5K pf $\pm 2\%$, 300 vdcw	72136	DM20F502G(300V)	1			
0140-0183	C: fxd, mica, 5.6K pf $\pm 1\%$, 300 vdcw	72136	DM20F562F(300V)	1			
0140-0184	C: fxd, mica, 8.2K pf $\pm 1\%$, 100 vdcw	72136	DM20F822F(100V)	1			
0140-0185	C: fxd, mica, 0.01 μ f $\pm 5\%$, 100 vdcw	72136	DM30F103J(100V)	2			
0140-0186	C: fxd, mica, 0.02 μ f $\pm 1\%$, 300 vdcw	72136	DM30F203F(300V)	1			
0140-0187	C: fxd, mica, 0.027 μ f $\pm 5\%$, 100 vdcw	72136	DM30F273J(100V)	1			
0140-0188	C: fxd, mica, 0.05 μ f $\pm 1\%$, 300 vdcw	72136	DM42F503F(300V)	1			
0150-0012	C: fxd, cer, 0.01 μ f $\pm 20\%$, 100 vdcw	56289	29C214A3-H-1038	2			
0150-0022	C: fxd, TiO ₂ , 3.3 pf $\pm 10\%$, 500 vdcw	82142	Type JM	1			
0150-0031	C: fxd, TI Diox, 2 pf, $\pm 5\%$, 500 vdcw	78488	Type GA				
0150-0056	C: fxd, cer, 14 pf $\pm 3\%$, 500 vdcw	72982	315-000-COGO-				
			140H	2			
0150-0057	C: fxd, cer, 16 pf $\pm 3\%$, 500 vdcw	72982	315-000-COGO-				
			160H	2			
0150-0110	C: fxd, cer, 470 pf $\pm 5\%$, 300 vdcw	71590	Type CB TB64-				
			471J-P3K	1			
0150-0111	C: fxd, cer, 220 pf $\pm 5\%$, 300 vdcw	71590	Type CB TB60-				
			221J-Q3M	1			
0150-0112	C: fxd, cer, 390 pf $\pm 5\%$, 300 vdcw	71590	Type CB TB61-				
			391J-Q3M	1			
0150-0113	C: fxd, cer, 910 pf $\pm 5\%$, 300 vdcw	71590	Type CB TB62-				
			911J-Q3M	1			
0150-0114	C: fxd, cer, 2.8K pf $\pm 5\%$, 300 vdcw	71590	Type CB TB65-				
			282J-Q3M	1			
0150-0115	C: fxd, cer, 27 pf $\pm 10\%$, 500 vdcw	71590	Type CC20 TCN27	2			
0150-0116	C: fxd, cer, 47 pf $\pm 10\%$, 500 vdcw	71590	Type CC20 TCN47	2			
0150-0117	C: fxd, cer, 100 pf $\pm 10\%$, 500 vdcw	71590	Type CC20 TCN100	2			
0150-0118	C: fxd, cer, 200 pf $\pm 10\%$, 500 vdcw	71590	Type CC25 TCN200	2			
0160-0360	C: fxd, cer, 120 pf $\pm 5\%$, 500 vdcw	71590	DA163-022J				
0170-0022	C: fxd, my, 0.1 μ f $\pm 20\%$, 600 vdcw	84411	HEW 7	1			
0170-0033	C: fxd, my, 0.18 μ f $\pm 2\%$, 600 vdcw	09134	Type 27	2			
0170-0082	C: fxd, my, 0.01 μ f $\pm 20\%$, 50 vdcw	84411	601PE style 1, obd#	3			
0170-0083	C: fxd, my, 0.022 μ f $\pm 20\%$, 50 vdcw	84411	601PE style 1, obd#	2			

See introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

Stock No.	Description	Mfr.	Mfr. Part No.	TQ			
0170-0084	C: fxd, my, 0.068 μ f $\pm 20\%$, 50 vdcw	84411	601PE style 3, obd#	1			
0170-0085	C: fxd, my, 0.1 μ f $\pm 20\%$, 50 vdcw	84411	601PE style 3, obd#	4			
0170-0086	C: fxd, my, 0.22 μ f $\pm 20\%$, 50 vdcw	84411	601PE style 3, obd#	1			
0180-0011	C: fxd, elect, 20 μ f 450 vdcw	56289	D32550	1			
0180-0045	C: fxd, elect, 20 μ f, 25 vdcw	56289	Type 30D	1			
0180-0054	C: fxd, elect, 1.5K μ f, 10 vdcw	56289	D32495	2			
0180-0061	C: fxd, elect, 100 μ f + 100% -10%, 15 vdcw	56289	30D172A1	1			
0180-0089	C: fxd, elect, 10 μ f + 100% -10%, 150 vdcw	56289	30D218A1	1			
0180-0114	C: fxd, elect, 4 μ f + 100% -10%, 25 vdcw	56289	30D178A1	1			
0684-1001	R: fxd, comp, 10 ohms $\pm 10\%$, 1/4 W	01121	CB1001	1			
0684-1021	R: fxd, comp, 1K ohms $\pm 10\%$, 1/4 W	01121	CB1021	4			
0684-1041	R: fxd, comp, 100K ohms $\pm 10\%$, 1/4 W	01121	CB1041	4			
0684-1521	R: fxd, comp, 1.5K ohms $\pm 10\%$, 1/4 W	01121	CB1521	1			
0684-1531	R: fxd, comp, 15K ohms $\pm 10\%$, 1/4 W	01121	CB1531	8			
0684-3331	R: fxd, comp, 33K ohms $\pm 10\%$, 1/4 W	01121	CB3331	1			
0684-3921	R: fxd, comp, 3.9K ohms $\pm 10\%$, 1/4 W	01121	CB3921	2			
0684-4711	R: fxd, comp, 470 ohms $\pm 10\%$, 1/4 W	01121	CB4711	6			
0684-5611	R: fxd, comp, 560 ohms $\pm 10\%$, 1/4 W	01121	CB5611	2			
0684-5621	R: fxd, comp, 5.6K ohms $\pm 10\%$, 1/4 W	01121	CB5621	12			
0686-1025	R: fxd, comp, 1K ohms $\pm 5\%$, 1/2 W	01121	EB1025	2			
0686-1315	R: fxd, comp, 130 ohms $\pm 5\%$, 1/2 W	01121	EB1315	1			
0686-8235	R: fxd, comp, 82K ohms $\pm 5\%$, 1/2 W	01121	EB8235	2			
0687-1021	R: fxd, comp, 1K ohms $\pm 10\%$, 1/2 W	01121	EB1021	2			
0687-1521	R: fxd, comp, 1.5K ohms $\pm 10\%$, 1/2 W	01121	EB1521	1			
0687-1821	R: fxd, comp, 1.8K ohms $\pm 10\%$, 1/2 W	01121	EB1821	1			
0687-2231	R: fxd, comp, 22K ohms $\pm 10\%$, 1/2 W	01121	EB2231	1			
0687-3311	R: fxd, comp, 330 ohms $\pm 10\%$, 1/2 W	01121	EB3311	1			
0687-3321	R: fxd, comp, 3.3K ohms $\pm 10\%$, 1/2 W	01121	EB3321	1			
0687-6801	R: fxd, comp, 68 ohms $\pm 10\%$, 1/2 W	01121	EB6801	1			
0692-1135	R: fxd, comp, 11K ohms $\pm 5\%$, 2 W	01121	HB1135	2			
0698-3143	R: fxd, met flm 52.3K ohms $\pm 1\%$, 1/4 W	28480	0698-3143	1			
0721-0016	R: fxd, dep c, 66.5K ohms $\pm 1\%$, 1/8 W	19701	CF1/8, obd#	2			
0721-0017	R: fxd, dep c, 143K ohms $\pm 1\%$, 1/8 W	19701	CF1/8, obd#	2			
0721-0018	R: fxd, dep c, 876K ohms $\pm 1\%$, 1/8 W	19701	CF1/8, obd#	2			
0721-0019	R: fxd, dep c, 937K ohms $\pm 1\%$, 1/8 W	19701	CF1/8, obd#	2			
0727-0143	R: fxd, dep c, 6490 ohms $\pm 1\%$, 1/2 W	19701	DC1/2CR5, obd#	2			
0727-0196	R: fxd, dep c, 52.6K ohms $\pm 1\%$, 1/2 W	19701	DC1/2CR5, obd#	2			
0727-0204	R: fxd, dep c, 90K ohms $\pm 1\%$, 1/2 W	19701	DC1/2BR5, obd#	2			
0727-0205	R: fxd, dep c, 92.6K ohms $\pm 1\%$, 1/2 W	19701	DC1/2CR5, obd#	4			

See introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

Stock No.	Description	Mfr.	Mfr. Part No.	TQ			
0727-0221	R: fxd, dep c, 200K ohms $\pm 1\%$, 1/2 W	19701	DC1/2AR5, obd#	2			
0727-0233	R: fxd, dep c, 333K ohms $\pm 1\%$, 1/2 W	19701	DC1/2AR5, obd#	2			
0727-0244	R: fxd, dep c, 500K ohms $\pm 1\%$, 1/2 W	19701	DC1/2AR5, obd#	2			
0727-0254	R: fxd, dep c, 750K ohms $\pm 1\%$, 1/2 W	19701	DC1/2CR5, obd#	2			
0727-0274	R: fxd, dep c, 1M $\pm 1\%$, 1/2 W	19701	DC1/2AR5, obd#	4			
0757-0733	R: fxd, met flm, 1100 ohm, 1%, 1/4 W	28480	0757-0733				
0757-0769	R: fxd met flm 51.1K ohm, 1%, 1/4 W	28480	0757-0769				
0757-0783	R: fxd met flm, 221K ohm, 1%, 1/4 W	28480	0757-0783				
0760-0003	R: fxd, mfg, 18.7K ohms $\pm 2\%$, 1 W	07115	S-25, obd#	2			
0767-0010	R: fxd, mfg, 15K ohms $\pm 5\%$, 3 W	07115	LPI-3, obd#	4			
0819-0015	R: fxd, ww, 3K ohms $\pm 10\%$, 20 W	35434	C20-3000H	1			
1200-0008	Socket, tube: 9 pin	71785	44F-16388	4			
1200-0009	Socket, tube: 7 pin	91662	316PH-3702	1			
1200-0038	Socket, 12 pin	02660	77-MIP-12TM	2			
1200-0054	Socket, transistor: 4 pin	91662	(A) 3301	1			
1200-0061	Socket, power transistor	11717	PT-7719	1			
1250-0083	Connector, female: BNC, Type UG-1094/U	91737	UG-1094/U	2			
1250-0118	Connector, female: BNC, Type UG-1094A/U	91737	8427	1			
1251-0006	Connector, male: 16 pin	02660	26-4100-016P	1			
1251-0008	Connector, male: 8 pin	02660	26-4100-8P	1			
1850-0048	Transistor: 2N650	04713	2N650	4			
1850-0074	Transistor: 2N1396	02735	2N1396	7			
1850-0094	Transistor: 2N1360	04713	2N1360	1			
1901-0013	Diode, Si: 1N253	01295	1N253	2			
1902-0002	Diode, Si: 1N1594	93332	1N1594, 3Z12	1			
1902-0052	Diode, Si	28480	1902-0052	1			
1910-0003	Diode, Ge: 1N55A	08792	1N55A	6			
1910-0011	Diode, Ge: type HD-2135A-5	73293	HD-2135A-5	4			
1932-0032	Tube, elect: 7308	80131	7308	4			
1940-0010	Tube, elect: OG3	80131	OG3	1			
2100-0184	R: var, comp, lin, 250K ohms $\pm 10\%$, 2 W	01121	JA1N056S 254UA	2			
2100-0278	R: var, comp, lin, 50K ohms $\pm 10\%$, 2 W	01121	JA4G024S 503UA	2			
3100-0278	Switch, rot: 2 sect, 11 pos	76854	217034-K2	2			
3101-0038	Switch, tog: DPDT	04009	83054-B	2			
9140-0022	Inductor, fxd: 500 μ h	99848	1500-15-501	1			
9140-0053	Inductor, fxd: 1 mh	99848	31000-15-102	3			
9140-0109	Inductor, fxd: 280 μ h	99848	3280-15-281	2			
<u>MISCELLANEOUS</u>							
0370-0029	Knob, black: 1" w/arrow TRIGGER LEVEL	28480	0370-0029	2			
526D-74A	Knob: INPUT VOLTAGE RANGE	28480	526D-74A	2			

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Table 6-3. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 handbooks.

Code No.	Manufacturer	Address	Code No.	Manufacturer	Address	Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
00000	U. S. A. Common	Any supplier of U. S.	07126	Digital Corp.	Pasadena, Calif.	17474	Traxen Company	Mountain View, Calif.	71707	Colo Coil Co., Inc.	Providence, R. I.
00136	McCoy Electronics	Mount Holly Springs, Pa.	07137	Transistor Electronics Corp.	Minneapolis, Minn.	18042	Power Design Pacific Inc.	Palo Alto, Calif.	71744	Chicago Miniature Lamp Works	Chicago, Ill.
00213	Sage Electronics Corp.	Rochester, N. Y.	07138	Westinghouse Electric Corp	Elmira, N. Y.	18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.	71753	A. O. Smith Corp., Crowley Div	West Orange, N. J.
00287	Cemco Inc.	Danuelson, Conn.	07149	Firmholt Corp.	New York, N. Y.	18486	Radio Industries	Des Plaines, Ill.	71785	Cinch Mfg. Co., Howard B. Jones Div	Chicago, Ill.
00334	Humical	Colton, Calif.	07233	Cinch-Graphik Co.	City of Industry, Calif.	18583	Curtis Instrument, Inc.	Mt. Kisco, N. Y.	71984	Dow Corning Corp.	Midland, Mich.
00373	Garlock Inc.,	Camden, N. J.	07261	Avnet Corp.	Los Angeles, Calif.	18673	E. J. DuPont and Co., Inc.	Wilwaukee, Wis.	72136	Electro Motive Mfg. Co., Inc.	Williamham, Conn.
00556	Amovox Corp.	New Bedford, Mass.	07263	Fairchild Camera & Inst. Corp.	Mountain View, Calif.	18911	Durant Mfg. Co.	Teterboro, N. J.	72354	John E. Fast Co., Div. Victrolene Instr. Co.	Chicago, Ill.
00719	Amg, Inc.	Harrisburg, Pa.	07372	Minnesota Rubber Co.	Minneapolis, Minn.	19315	Bendix Corp., The	West Orange, N. J.	72619	Dia-light Corp.	Brooklyn, N. Y.
00781	Aircraft Radio Corp.	Boston, N. J.	07387	Britcher Corp., The	Monterey Park, Calif.	19500	Thomas A. Edison Industries, Div. of	Horseheads, N. Y.	72656	Indiana General Corp., Electronics Div	Kearby, N. J.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.	07700	Technical Wire Products Inc.	Cranford, N. J.	19644	LRC Electronics	Independence, Kansas	72765	Diak Mfg. Co.	Chicago, Ill.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S. C.	07910	Consental Device Corp.	Hawthorne, Calif.	20183	General Altronics Corp.	Philadelphia, Pa.	72825	Hugh H. Eby Inc.	Philadelphia, Pa.
00866	Gee Engineering Co.	Los Angeles, Calif.	07933	Raytheon Mfg. Co.	Mountain View, Calif.	21226	Excelsior, Inc.	New York, N. Y.	72928	Gudeman Co.	Chicago, Ill.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.	07966	Shockley Semi-Conductor Laboratories	Palo Alto, Calif.	21335	Fairair Bearing Co., The	New Britain, Conn.	72964	Robert M. Hadley Co.	Los Angeles, Calif.
01121	Allen Bradley Co.	Milwaukee, Wis.	07980	Hewlett-Packard Co., Bountion Radio Div.	Rockaway, N. J.	21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.	72982	Erie Technological Products, Inc.	Erie, Pa.
01255	Liton Industries, Inc.	Beverly Hills, Calif.	08145	U. S. Engineering Co.	Los Angeles, Calif.	24455	G. E. Lamp Division	Nela Park, Cleveland, Ohio	73061	Hansen Mfg. Co., Inc.	Pinceton, Ind.
01281	TRW Semiconductor, Inc.	Lawndale, Calif.	08289	Blindt Albert Co.	Pomona, Calif.	24655	General Radio Co.	West Concord, Mass.	73076	H. M. Harper Co.	Chicago, Ill.
01285	Texas Instruments, Inc.,	Dallas, Texas	08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada	26365	Gries Reproductor Corp.	New Rochelle, N. Y.	73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Calif.
01349	The Alliance Mfg. Co.	Van Nuys, Calif.	08664	Bristol Co., The	Waterbury, Conn.	26462	Gibbet File Co. of America, Inc.	Carlstadt, N. J.	73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
01599	Pacific Relays, Inc.	Rockford, Ill.	08717	Sloan Company	San Valley, Calif.	26992	Hamilton Watch Co.	Lancaster, Pa.	73445	Amperex Electronic Co., Div. of North American Philips Co., Inc.	Hicksville, N. Y.
01930	Aeromac Corp.	Santa Clara, Calif.	08718	ITT Cannon Electric Inc.,	Phoenix, Arizona	28480	Hewlett-Packard Co.	Palo Alto, Calif.	73506	Briley Semiconductor Corp.	New Haven, Conn.
01961	Pulse Engineering Co.	Saugerties, N. Y.	08792	CBS Electronics Semiconductor Operations, Div. of C. B. S. Inc.	Lowell, Mass.	31373	G. E. Receiving Tube Dept.	Owensboro, Ky.	73559	Carling Electric, Inc.	Haiford, Conn.
02114	Ferroxcube Corp. of America	Sunnyvale, Calif.	08984	Mel-Rain	Indianapolis, Ind.	35434	Lectrohm Inc.	Chicago, Ill.	73682	George N. Garrett Co., Div. MSL Industries Inc.	Philadelphia, Pa.
02286	Col Rubber and Plastics Inc.	Sunnyvale, Calif.	09026	Babcock Relays Div.	Costa Mesa, Calif.	35436	Stanway Coil Products Ltd	Hawkesbury, Ontario, Canada	73734	Federal Screw Products Inc.	Chicago, Ill.
02350	Amphenol-Borg Electronics Corp.	Chicago, Ill.	09134	Texas Capacitor Co.	Houston, Texas	37842	P. R. Mallory & Co. Inc.	Indianapolis, Ind.	73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
02656	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N. J.	09145	Alpha Electronics	San Valley, Calif.	39543	Mechanical Industries Prod. Co.	Akron, Ohio	73793	General Industries Co., The	Elyria, Ohio
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.	09250	Electro Assemblies, Inc.	Chicago, Ill.	42180	Muler Co.	Chicago, Ill.	73850	Goshay Stamping & Tool Co.	Goshen, Ind.
02777	Hopkins Engineering Co.	San Fernando, Calif.	09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada	44555	Ohmite Mfg. Co.	Shakopee, Minn.	73895	JFD Electronics Corp.	Brooklyn, N. Y.
03508	G. E. Semiconductor Prod. Dept.	Syracuse, N. Y.	10014	General Transistor Western Corp.	Los Angeles, Calif.	47904	Polairad Corp.	Cambridge, Mass.	73905	Jennings Radio Mfg. Corp.	San Jose, Calif.
03705	Aero Machine & Tool Co.	Dayton, Ohio	10411	Tri-Tal, Inc.	Berkeley, Calif.	48290	Precision Thermometer & Inst. Co.	Southampton, Pa.	73926	Signalite Inc.	Neptune, N. J.
03787	Eidena Corp.	Compton, Calif.	10446	Calandrom Co.	Niagara Falls, N. Y.	49956	Microwave & Power Tube Div.	Waltham, Mass.	74455	J. H. Wines, and Sons	Winchester, Mass.
03797	Transitron Electric Corp.	Wakefield, Mass.	11236	CTS of Geneva, Inc.	Berne, Ind.	50090	Rowan Controller Co.	Westminster, Md.	74861	Industrial Condenser Corp.	Chicago, Ill.
03888	Pyrilum Resistor Co., Inc.	Cedar Knolls, N. J.	11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.	52983	Samborn Company	Waltham, Mass.	74868	R. F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
03954	Singer Co., Diehl Div.	Sumerville, N. J.	11242	Bay State Electronics Corp.	Waltham, Mass.	54294	Shallcross Mfg. Co.	Selma, N. C.	74910	E. F. Johnson Co.	Waco, Tex.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.	11312	Microwave Electronics Corp.	Palo Alto, Calif.	55026	Simpson Electric Co.	Chicago, Ill.	75042	International Resistance Co.	Philadelphia, Pa.
04013	Taurus Corp.	Lambertville, N. J.	11534	Duncan Electronics Inc.	Costa Mesa, Calif.	55933	Sonolone Corp.	Elmsford, N. Y.	75378	Jones Knights Co.	Sandwich, Ill.
04062	Elmenco Products Co.	New York, N. Y.	11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N. J.	55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.	75382	Kulka Electric Corporation	Mt. Vernon, N. Y.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S. C.	11717	Imperial Electronic, Inc.	Buena Park, Calif.	56137	Spaulding Fibre Co., Inc.	Tonawanda, N. Y.	75818	Lenz Electric Mfg. Co.	Chicago, Ill.
04454	Precision Paper Tube Co.	Chicago, Ill.	11870	Metals, Inc.	Palo Alto, Calif.	56289	Sprague Electric Co.	North Adams, Mass.	75915	Littelfuse, Inc.	Des Plaines, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.	12136	Philadelphia Handle Co.	Camden, N. J.	58445	Talco, Inc.	St. Paul, Minn.	76005	Lord Mfg. Co.	Erie, Pa.
04651	Sylvania Electric Products Div.	Mountain View, Calif.	12697	Claroal Mfg. Co.	Dover, N. H.	59370	Thomas & Betts Co.	Elizabeth, N. J.	76210	C. W. Marwell	San Francisco, Calif.
04713	Motrola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona	12859	Nippon Electric Co., Ltd.	Tokyo, Japan	60741	Triplet Electric Inst. Co.	Bluffton, Ohio	76433	General Instrument Corp., Micromold Div.	Newark, N. J.
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.	12881	Metex Electronics Corp.	Clark, N. J.	61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.	76487	James Milten Mfg. Co., Inc.	Malden, Mass.
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04822	P. M. Motor Company	Westchester, Ill.	13396	Telefunken (GmbH)	Hanover, Germany	65092	Weston Inst. Inc. Weston-Newark	Newark, N. J.	76854	Oak Manufacturing Co.	Crystal Lake, Ill.
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05277	Westinghouse Electric Corp. Semi-Conductor Dept.	Youngwood, Pa.	14099	Sen-Tech	Newbury Park, Calif.	66346	Revere Wollansk Div. Minn. Mining & Mtl. Co.	St. Paul, Minn.	77075	Bendix Pacific Div.	N. Hollywood, Calif.
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07088	Keivin Electric Co.	San Nuy, Calif.	16758	Delco Radio Div. of G. M. Corp.	Kokomo, Ind.	71590	Centralab Div. of Globe Union Inc.	Chicago, Ill.	79136	Valdes Kohinoor Inc.	Long Island City, N. Y.
			17109	Thermometrics Inc.	Canoga Park, Calif.	71716	Commercial Plastics Co.	Chicago, Ill.	79147	Weeder Root, Inc.	Haiford, Conn.
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									79727	Continental Wire Electronics Corp.	Philadelphia, Pa.
									79953	Zienck Mfg. Corp.	New Rochelle, N. Y.

00015-41
Revised November, 1965

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H4-1 Dated JULY 1965
H4-2 Dated NOV 1962

THE FOLLOWING 40 VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS - HANDBOOK		
0005F	Marico Tool and Die	Los Angeles Calif
0006W	Western Gun Div. of Automatic Ind. Inc.	Redwood City Calif
0006Z	Wilow Leather Products Corp.	Newark, N. J.
0006A	British-Radio Electronics Ltd	Washington D C
0006B	ETA	England
0009B	Precision Instrument Components Co.	Van Nuys Calif
0000M	Robber Eng. & Development	Hayward Calif
0000N	A. C. Mfg. Co.	San Jose Calif
0000P	Calvin Corp.	Quincy Calif
0000R	California Eastern Lab.	Berkeley Calif
0000Y	S. K. Smith Co.	Los Angeles, Calif

APPENDIX I - MANUAL CHANGES

This manual applies directly to the 526D Phase Units serial prefix 616. This manual with the following changes also applies to 526D Phase Units having serial prefix numbers 209, 134, and 117.

Instrument Serial No. Prefix	Change No.
209	1
134	1, 2
117	1, 2, 3

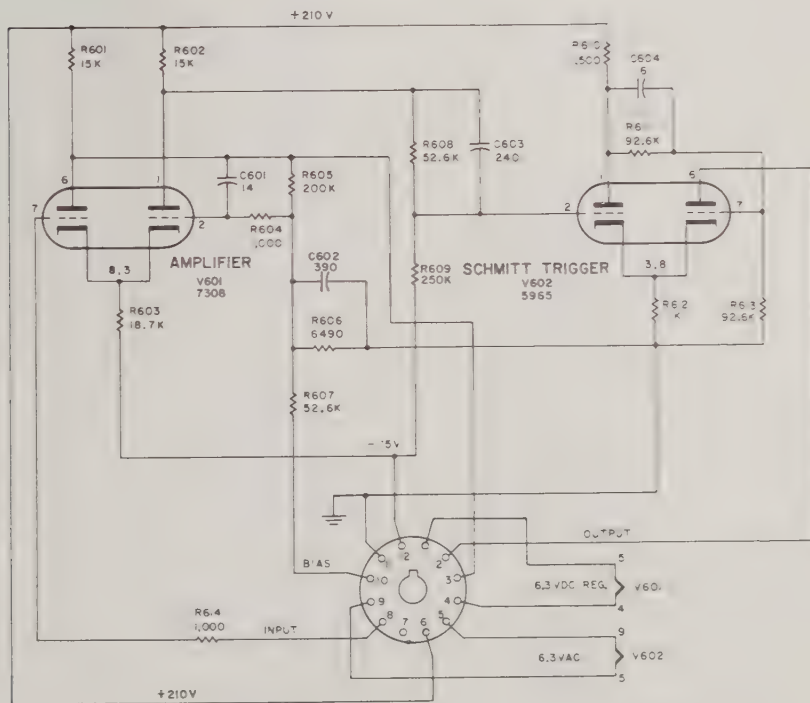
CHANGE 1:

Figure 5-4, Page 5-8,

Replace Figure 5-4, 00526-6002 with Figure 5-4, 526D-58A.

Table 6-1

Change:

C603 from 101.4 pf to 240 pf, Φ Part No. 0140-0111.R608 from 51.1K ohms to 52.6K ohms, Φ Part No. 0727-0196.R609 from 221K ohms to 250 ohms, Φ Part No. 0727-0769.

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526D-58A - TBC, JAN-7-1-7A

NOTES

UNLESS OTHERWISE STATED, CAPACITY IN pf, RESISTANCE IN OHMS.

REFERENCE DESIGNATORS

C601 - 604
R601 - 614
V601, 602

R610 from 1100 ohms to 1500 ohms, Φ Part No. 0686-1525.V602 from 7308 to 5965, Φ Part No. 1932-0009.

Delete: C605 2 pf, C606 17 pf.

CHANGE 2:

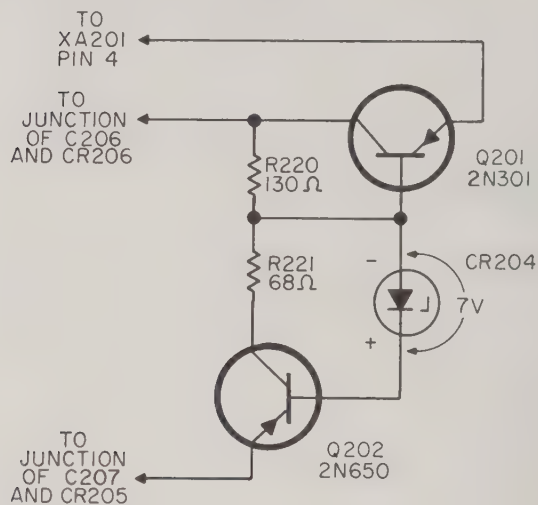
Figure 5-6, Table 6-1,

Change: Q201 to 2N301, Φ Part No. 1850-0038.

CHANGE 3:

Figure 5-6,

Change Power Supply circuit of Q201 and Q202 as shown in partial schematic.



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